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Maternal and Umbilical Cord Blood Levels of Zinc and Copper in Active Labor Versus Elective Caesarean Delivery at Khartoum Hospital, Sudan

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Abstract A case–control study was conducted in Khartoum Hospital Sudan to determine maternal and umbilical cord blood levels of zinc and copper in active labor versus elective cesarean delivery. Cases were women delivered vaginally and controls were women delivered by elective cesarean (before initiation of labor). Paired maternal and cord zinc and copper were measured using atomic absorption spectrophotometry. The two groups (52 paired maternal and cord in each arm) were well matched in their basic characteristics. In comparison with cesarean delivery, the median (interquartile range) of both maternal [87.0 (76.1–111.4) vs. 76.1 (65.2–88.3) μg/dL, $P = 0.004$] and cord zinc [97.8 (87.0–114.1) vs. 81.5(65.2–110.2) μg/dL $P = 0.034$] levels were significantly higher in the vaginal delivery. While there was no significant difference in the maternal copper [78.8 (48.1–106.1) vs. 92.4 (51.9–114.9) μg/dL, $P = 0.759$], the cord copper [43.5(29.9–76.1) vs. 32.2(21.7–49.6) μg/dL, $P = 0.019$] level was significantly higher in vaginal delivery. There was no significant correlation between zinc (both maternal and cord) and copper. While the cord zinc was significantly correlated with maternal zinc, there was no significant correlation between maternal and cord copper. The current study showed significantly higher levels of maternal and cord zinc and cord copper in women who delivered vaginally compared with caesarean delivery.

Keywords Zinc · Copper · Cesarean delivery · Pregnancy · Sudan

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Introduction

Trace elements such as selenium, zinc and copper are essential nutrients with regulatory, immunologic and antioxidant functions resulting from their actions as essential components or cofactors of enzymes throughout metabolism [1, 2]. Trace elements are also essential cofactors for metalloproteinases and the enzymes catalase, superoxide dismutase (SOD) and cytochrome oxidase [3].

Pregnancy is the period of increased metabolic demands, and deficiency of one or more of the trace elements can lead to adverse maternal and perinatal outcomes [4]. The transport of the trace element to the fetus is not fully understood; while some elements have active, the others have passive placental transport [5, 6].

Although the exact mechanism initiating labor is not fully understood, during labor, the metabolic requirements increase sharply for both the mother and the fetus [7]. Currently, there are two plausible general hypotheses for human parturition; pregnancy maintenance hypothesis and the uterotonin,

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ORIGINAL ARTICLE

Association of APC I1307K and E1317Q polymorphisms with colorectal cancer among Egyptian subjects

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Abstract Colorectal cancer is a multifactorial disease that involves both environmental and genetic factors. The gene encoding adenomatous polyposis coli (*APC*) has been reported to be associated with colorectal cancer (CRC) risk in several ethnic populations. The aim of this work is to assess the association of the *APC I1307K* and *E1317Q* polymorphisms with CRC risk among Egyptian subjects. This study included 120 unrelated CRC Egyptian patients who were compared to 100 healthy controls from the same locality. For all subjects, DNA was genotyped for *APC I1307K and E1317Q* polymorphisms using the PCR-ARMS technique. The frequency of *APC I1307K* carrier (TA+AA genotypes) was noted to be significantly higher among cases with CRC compared to controls (18.3 vs. 9.0 %, OR 2.58, 95 % CI 1.09–6.09, $p = 0.03$). Also the frequency of the *APC I1307K A* allele was significantly higher among cases compared to controls (10.4 vs. 4.5 %, OR 2.47; 95 % CI 1.12–5.42, $p = 0.03$). On the contrast, the frequencies of *APC E1317Q* GC genotype and C allele showed no significant difference among CRC patients compared to controls (3.3 vs. 2.0 %, OR 1.69; 95 % CI 0.30–9.42, $p = 0.69$ and 2.1 vs. 1.0 %, OR 2.11; 95 % CI 0.40–10.97, $p = 0.46$, respectively). Cases of the *APC I1307K* and *E1317Q* carriers (TA+AA and GC) showed no significant difference compared to those with *I1307K* and *E1317Q* non-carriers (TT and GG) regarding their clinical and laboratory markers. *APC I1307K* variant was associated with an increased risk of CRC among Egyptian subjects.

Keywords Colorectal cancer · Gene polymorphism · *APC I1307K* · *APC E1317Q*

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Introduction

Colorectal cancer (CRC) is the third most common type of cancer and the fourth leading cause of cancer mortality diagnosed worldwide [1, 2]. It is characterized by a series of genetic aberrations that transform the normal colonic epithelium into an invasive cancer [3]. Colorectal cancer occurs sporadically in most of the patients, and only 25 % of the patients have a family history of the disease, suggesting a contribution of both gene-environment interactions [3, 4]. The development of colorectal cancer is a sequential process that involves an accumulation of both mutations and epigenetic modifications of several genes. However, the morphology change from normal epithelium to carcinoma occurs through a multistep genetic model with the loss of the function of tumor suppressor genes [4, 5].

The adenomatous polyposis coli (APC) gene is considered as one of tumor suppression genes that located at chromosome 5q21 [6]. The protein encoded by the APC gene have a major function in controlling the Wnt signaling pathway that regulates the differentiation and proliferation of cells in the intestinal epithelium [7]. The activity of the

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Punching of slab–column connections strengthened using external steel shear bolts
Baig, Alsayed and Abbas

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Punching of slab–column connections strengthened using external steel shear bolts

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This paper describes the use and effectiveness of external steel shear bolts as shear reinforcement for retrofitting of slab–column connections in reinforced concrete (RC) flat plates and also compares the behaviour of slab–column connections with finite-element analysis. Four full-scale test specimens, representing interior slab–column connections in RC flat plates, were cast. Two concrete grades – low strength (14 MPa) and normal strength (28 MPa) – were used. One specimen for each concrete grade was used as a control and the other was strengthened using external steel shear bolts as the transverse shear reinforcement. The slab–column specimens were tested experimentally and their numerical models were analysed using Ansys. The results obtained through static non-linear analysis compared well with the experimental data. Shear strengthening of slabs changed the failure mode of the test specimens from punching shear to flexural mode and increased the ultimate load capacity of the slab–column connection by 64–73%. The shear strengthening also resulted in increased deflections and ductility. Analytical predictions of ultimate load were in good agreement with the experiments.

Notation

A_s	area of shear bolts
b_0	critical shear perimeter
c	side length of square column
D	thickness of slab
d	effective depth of slab
d_g	maximum size of aggregate
d_{g0}	reference size of aggregate (= 16 mm)
E_c	elastic modulus of concrete
E_s	modulus of elasticity of flexural steel
E_{ss}	modulus of elasticity of shear bolts
f_{bd}	bond stress between bolts and concrete
f_c'	cylinder compressive strength of concrete
f_{ct}	splitting tensile strength of concrete
f_r	modulus of rupture of concrete
f_y	yield stress of flexural steel
f_{ys}	yield stress of shear bolts
L	span of test slab
M_r	moment of resistance of slab
M_s	bending moment due to external load
P_c	first crack load
P_u	ultimate load
r_s	distance of lines of contraflexure from column
V_{flex}	flexural load carrying capacity of slab
V_u	ultimate punching shear load
V_{uc}	shear load carried by concrete
V_{us}	shear load carried by shear bolts
α	angle between shear bolts and slab axis
β	rotation of slab
Δ_f	failure displacement
Δ_u	ultimate displacement
Δ_y	yield displacement
δ_f	ductility at failure
δ_u	ductility at peak
ρ	steel ratio of flexural reinforcement of slab
σ_i	initial stress in shear bolts
σ_s	stress in shear bolts
τ_{cf}	punching shear strength of concrete
ϕ_s	diameter of shear bolts

Introduction

Punching shear failures in flat plates have been studied extensively and several methods have been proposed for improving the punching shear capacity at the design stage (Ko and Choi, 2013; Koppitz *et al.*, 2013), but the need for improvement after construction requires efficient and viable strengthening techniques. Several traditional techniques are available for the shear strengthening of slab–column connections, but in most cases are either expensive or difficult to

The Pediatric Vestibular Symptom Questionnaire: A Validation Study

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Objective To develop and validate the Pediatric Vestibular Symptom Questionnaire (PVSQ) and quantify subjective vestibular symptom (ie, dizziness, unsteadiness) severity in children.

Study design One hundred sixty-eight healthy children (female, n = 91) and 56 children with postconcussion dizziness or a vestibular disorder (female, n = 32), between ages 6 and 17 years, were included. The PVSQ contains questions regarding vestibular symptom frequency during the previous month. The Strengths and Difficulties Questionnaire (SDQ), a brief behavioral screening instrument, was also completed.

Results The PVSQ showed high internal consistency (10 items; Cronbach $\alpha = 0.88$). A significant between-group difference was noted with higher (ie, worse) PVSQ scores for children with vestibular symptoms ($P < .001$); no significant differences were noted between patient groups. The optimal cut-off score for discriminating between individuals with and without abnormal levels of vestibular symptoms was 0.68 out of 3 (sensitivity 95%, specificity 85%). Emotional and hyperactivity SDQ subscale scores were significantly worse for patients compared with healthy participants ($P \leq .01$). A significant relationship was noted between mean PVSQ and SDQ (parent-rated version) hyperactivity and total scores for patients ($P \leq .01$) and the SDQ (self-rated) emotional, hyperactivity, and total score ($P \leq .01$) in healthy controls. However, mean SDQ subscale and total scores were within normal ranges for both groups.

Conclusions Self-reported vestibular symptoms, measured by the PVSQ, discriminated between children presenting with vestibular symptoms and healthy controls and should be used to identify and quantify vestibular symptoms that require additional assessment and management. *(J Pediatr 2016;168:171-7)*.

Vestibular disorders are the most common cause of dizziness in children with a prevalence of 0.7%-15%.[1-3] Vestibular migraine, benign paroxysmal vertigo of childhood (a migraine precursor), postconcussion dizziness because of head trauma, and viral vestibular neuritis are the most common diagnoses.[4-7] However, these disorders may often remain undiagnosed in children[8] as medical professionals may attribute symptoms to a behavioral disorder or "clumsiness."[9,10] This may partly be because children are often unable to express or describe their symptoms without appropriate questioning, may readily accept the symptom terminology proposed by an adult, and may demonstrate behaviors such as clinging to the parent when experiencing dizziness or vertigo.[5,10,11] Vestibular disorders may lead to secondary psychological symptoms and avoidance behaviors with adverse effects on educational achievement and quality of life.[12,13] A detailed medical history, to ascertain symptoms, triggers, and time course, is the cornerstone of the diagnostic decision-making process.[4,5] It is, therefore, of the utmost importance to help a child explain his/her symptoms by providing different descriptors, in order to determine etiology and establish a diagnosis.[11] Although a number of questionnaires[14,15] exist to assess the presence, severity, and impact of vestibular symptoms in adults, there are currently none available for the pediatric population.

This study aimed to develop and validate a questionnaire, the Pediatric Vestibular Symptom Questionnaire (PVSQ), to identify and quantify subjective vestibular symptoms (ie, dizziness, imbalance) in children between 6 and 17 years of age. A secondary study aim was to investigate the relationship between vestibular symptoms and behaviors indicative of psychological problems in healthy children and those with a vestibular disorder or concussion.

Methods

The PVSQ aimed to identify and measure the severity of common vestibular symptoms in children. The design and validation[16,17] consisted of 3 main phases: (1) expert panel review of initial PVSQ items; (2) pilot study to assess the validity

GOSH	Great Ormond Street Hospital
PAF	Principal axis factoring
PVSQ	Pediatric Vestibular Symptom Questionnaire
ROC	Receiver operating characteristic
SDQ	Strengths and Difficulties Questionnaire

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MEDICAL STUDENTS' PERCEPTIONS OF COMPLEMENTARY AND ALTERNATIVE MEDICINE THERAPIES: A PRE- AND POST-EXPOSURE SURVEY IN MAJMAAH UNIVERSITY, SAUDI ARABIA

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Abstract

Background: Evidently, Complementary and Alternative Medicine (CAM) is increasingly a recognized medical practice that efficiently uses multiple treatment therapies and techniques in promoting the health and wellbeing of people as well as preventing and managing a variety of human disorders. Research in CAM, which courses exposure to diverse healthcare professionals, is important from many perspectives including improvement in teaching skills of faculty, enhancing capacity building, and innovative curriculum development. This pre- and post-design cross-sectional study aimed to assess perceptions, training needs, personal usage, use in office practice, and knowledge of two batches of medical students toward CAM therapies in Majmaah University, Saudi Arabia.
Materials and Methods: The second year medical students of the first (year 2012-13) and second (year 2013-2014) batch [n=26 & 39, respectively] were selected for this study. A reliable 16-item self-administered questionnaire was distributed among all students for answering before and after the 48-hour specific 19 CAM therapies course, in terms of CAM therapies are clearly conventional or alternative, training needs, effectiveness, personal use, use in practice, management of two clinical cases by CAM or conventional therapies, and views about which evidence based approach strongly support individual CAM modalities.
Results: Medical students' knowledge and perceptions of CAM therapies significantly improved across some sub-items of CAM questionnaire with a positive trend in the rest of its items including their views about CAM therapies, need for further training, personal use of therapies and advising patients regarding CAM practices strongly supported by randomized clinical controlled trials and published case studies.
Conclusion: CAM course tends to have positive impact on the knowledge and perceptions of medical students, in addition to need for further training, and personal use and use of CAM therapies in practice in line with strong evidence-based data regarding therapeutic efficacy. The preliminary results of this study call for further research in specific CAM modalities with a larger sample in academic settings across the nation.

Key words: Medical students; Complementary and Alternative Medicine; CAM course; CAM therapies; pre-post design study; Saudi Arabia.

Introduction

Unorthodox medical systems have diverse intervention approaches directed toward balancing mind-body-spirit dimension of a whole person with or without disease (Karff, 2009; Haylock, 2010). Traditional therapies that advocate the holistic concept (Lie & Boker, 2006; Qureshi & Al-Bedah, 2013; Ujala et al., 2007) were used effectively in innumerable diseases since ancient times, though research in holistic system approaches remained poorly organized (Chiappelli et al., 2005). However, over the past few decades, research into complementary and alternative medicine [CAM] is beginning to reveal empirically the underlying mechanisms of actions and effectiveness of traditional treatment modalities in various diseases (Cramer, 2014; Akan et al., 2012; Busse et al., 2008; Adrian & Clare, 2003; Liu et al., 2013), which accordingly are cost-effective and efficient with minor adverse effects comparable to placebo (Herman et al., 2012; Bulletin World Health Organization, 2004). A large number of surveys conducted worldwide evidenced the emerging popularity of CAM use mostly in poor population and under-served communities, either adjunctive or alternative, in human diseases attributable to a variety of plausible reasons including patients' dissatisfaction with, poor outcomes, severe adverse effects, free market forces, consumers' demands, and high costs of allopathic medications (Nahin et al., 2007; Davis & Weeks, 2012; Barnes et al., 2008; Halterman-Cox et al., 2009; Wolsako et al., 2000).

In the Eastern world, the bedrock of unorthodox medicine, traditional medical schools were established long time back to meet the increasing demand of health consumers and health providers, and to regulate CAM practices with a focus on clinical research and training issues. Similar developmental trends driven by policy statements of influential bodies (Institute of Medicine, 2005; White House Commission CAM, 2005) have been rapidly emerging in the Western world (Brokaw, 2002). Notably, despite several challenges and barriers (Sierpina et al., 2007; Frenkel & Arye, 2001), CAM curriculum is being increasingly incorporated in many universities of the world to teach medical students about CAM practices (Levine et al., 2003; Bhattacharya, 2000). How medical students and healthcare professionals perceive CAM and also how they develop their related knowledge and practice is relatively an old avenue for research in the Eastern world, though the western world has produced huge data on this particular perspective over few decades (Chaterji et al., 2007).

Local Scenario of CAM

A PubMed search of relevant literature using key word complementary and alternative medicine retrieved a dozen of articles on CAM (Elolemy & Al-Bedah, 2012; Al-Rowais et al., 2010; Al-Zahim et al., 2013; Al-Bedah et al., 2012; Al-Rowais et al., 2012; Al-Bedah et al., 2013; Jazieh et al., 2012; Gad et al., 2013; Al-Faris et al., 2008; Alkharfy, 2010; Awad et al., 2012; Allam et al., 2014; Al-Rukban et al., 2012), however, only few studies assessed the knowledge, attitude and practice (KAP) of health professionals and consumers in Eastern Mediterranean region countries (Elolemy & Al-Bedah, 2012; Al-Bedah et al., 2012; Al-Rowais et al., 2012; Al-Bedah et al., 2013; Alkharfy, 2010). The results

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Remediation of lead and cadmium-contaminated soils

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ABSTRACT

The research was designated to study the ability of plants to bio-accumulate, translocate and remove the heavy metals, lead and cadmium from contaminated soil. The herbal plant ryegrass, *Lolium multiflorum* was investigated as a bio-accumulator plant for these metals. The translocation of these heavy metals in the herbal plant was compared considering root to shoot transport and redistribution of metals in the root and shoot system. The trace metal contents from root and shoot parts were determined using atomic absorption spectrometer. The results showed that the percent of lead and cadmium transferred to ryegrass plant were averaged as 51.39, and 74.57%, respectively, while those remained in the soil were averaged as 48.61 and 25.43% following 60 days of treatment. The soil-plant transfer index in root and shoot system of ryegrass was found to be 0.32 and 0.20 for lead, and 0.50 and 0.25 for cadmium. These findings indicated that the herbal plant ryegrass, Lolium multiflorum is a good accumulator for cadmium than lead. The soil-plant transfer factor (the conc. of heavy metal in plant to the conc. in soil) indicated that the mechanism of soil remedy using the investigated plant is phytoextraction where the amounts of heavy metals transferred by plant roots into the above ground portions were higher than that remained in the soil. The method offers green technology solution for the contamination problem since it is effective technology with minimal impact on the environment and can be easily used for soil remedy.

KEY WORDS

phytoremediation; soil; lead; cadmium; contamination

Introduction

Contamination has been increased due to the anthropogenic activities including emission, effluents and solid discharge from industries, vehicle exhaustion, metals from smelting and mining, use of pesticides, disposal of industrial and municipal wastes in agriculture, and excessive use of fertilizers (McGrath, Zhao, and Lombi 2001; Schalscha and Ahumada 1998). Atmospheric fall-out, pesticides, fertilizers and irrigation with water of poor quality are the cause of soil contamination with metals (Marcovecchio, Botte, and Freije 2007). Contamination with lead can come from mining and smelting, burning of leaded gasoline, municipal sewage and paints (Gisbert *et al.* 2003; Seaward and Richardson 1990), while cadmium may come from metal smelting and refining, fossil fuel burning or application of phosphate fertilizers (Alloways 1995; Kabata-Pendias 2001). These metals cannot be destroyed biologically but are only transformed from one oxidation state or organic complex to another. Pollution poses a great potential threat to the environment and human health.

Phytoremediation process is defined as the use of plant species to reduce the volume, mobility, or toxicity of contaminants in soil, groundwater or other contaminated media (USEPA 2000). The use of this method for cleaning polluted soils has gained increasing attention as an emerging effective and inexpensive technology (Macek, Mackova, and Kas 2000; Susarla, Medina, and McCutcheon 2002; Xia, Wu, and Tao 2003). Also, it has a minimal impact on the environment (McKinlay and Kasperek 1999). These plants keep contamination from spreading to other areas through the action of wind, rain and groundwater (EPA 2001, Perez, Garcia, and Esparza 2002; Glick 2003; Olowoyo *et al.* 2012; Badr, Fawzy, and Al-Qahtani 2012; Luo, Zhang, and Chen 2012). On the other hand, some disadvantages of phytoremediation process (phytoextraction) should be taken into consideration. Metal hyperaccumulators are generally slow-growing with a small biomass and shallow root systems and plant biomass must be harvested and removed, followed by metal reclamation or proper disposal of the biomass (USEPA 2000; Italiya and Shah 2013).

The effectiveness of the annual ryegrass has been used in the remediation of soil freshly contaminated with trinitrotoluene and polybromoinated biphenyls (Sung *et al.* 2004). Salama, Osman, and Gouda (2014) found that the herbal plant ryegrass able to remove zinc and copper from the contaminated soil. They indicated that 84.51 and 96.01% of zinc and copper were transferred from soil to the plant, respectively.

Therefore, the research was designated to study the ability of the herbal plant ryegrass, *Lolium multiflorum* to bio-accumulate, translocate and remove lead and cadmium from contaminated soil. This method is an in situ remediation technology, non-destructive, cost effective and can be used for soil cleanup.

Materials and methods

Experimental method

Soil for the experiment was taken from the farm of the College of Agriculture, Alexandria University, Egypt. The soil samples

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On magic numbers for super- and ultraheavy systems and hypothetical spherical double-magic nuclei

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Abstract

Based on the calculations of the shell and the residual pairing correction energies in the framework of Strutinsky's approach, we evaluated the proton and neutron magic numbers in the range $72 \leqslant Z \leqslant 282$ and $96 \leqslant N \leqslant 540$. New magic numbers and new islands of stability lie in a range defined by Green's formula and the two-neutrons drip lines are presented. Our calculations reproduced known spherical double-magic nuclei and present evidences on new spherical double-magic nuclei in super- and ultraheavy regions.

Keywords: Shell correction, superheavy nuclei, magic numbers

(Some figures may appear in colour only in the online journal)

1. Introduction

The precise location of shell and subshell closures across the nuclear landscape is believed to be one of the most critical pieces of information needed to allow the development of nuclear structure models and theory. Evidently, the location of shell closures is not static across the nuclear chart, and an ongoing experimental focus in nuclear physics is to locate these shell closures in previously unknown nuclei, and track the migration of single-particle orbitals which lead to this dynamic shell structure. Luckily, there are a number of experimental observables that are sensitive to the presence of shell closures across the nuclear landscape. Nuclear masses and binding energies provide the most fundamental mapping of structural evolution across the nuclear landscape. Also, changes in the trends of neutron-separation energies across isotopic chains, for example, can indicate the presence of neutron shell closures, or the development of deformation, depending on the nature of the observed change.

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Research Article

Influence of Thermal Radiation on Unsteady MHD Free Convection Flow of Jeffrey Fluid over a Vertical Plate with Ramped Wall Temperature

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Influence of thermal radiation on unsteady magnetohydrodynamic (MHD) free convection flow of Jeffrey fluid over a vertical plate with ramped wall temperature is studied. The Laplace transform technique is used to obtain the analytical solutions. Expressions for skin friction and Nusselt number are also obtained. Results of velocity and temperature distributions are shown graphically for embedded parameters such as Jeffrey fluid parameter λ, Prandtl number Pr, Grashof number Gr, Hartmann number Ha, radiation parameter Rd, and dimensionless time τ. It is observed that the amplitude of velocity and temperature profile for isothermal are always higher than ramped wall temperature.

1. Introduction

Investigation of non-Newtonian fluids has become very popular in this research area due to their wide range in industrial and technologies applications such as the plastic manufacture, performance of lubricants, food processing, or movement of biological fluids. Various models have been suggested to predict and describe the rheological behavior of non-Newtonian fluids. The Jeffrey fluid model is one of the subfamily of non-Newtonian fluids which has been given much attention in the present problem. This fluid is a relatively simple viscoelastic non-Newtonian fluid model that exhibits both relaxation and retardation effects [1].

Hayat and Mustafa [2] discussed the effect of the thermal radiation on the unsteady mixed convection flow of Jeffrey fluid past a porous vertical stretching surface analytically using homotopy analysis method. Hayat et al. [3] extended the previous idea to examine the flow of an incompressible Jeffrey fluid over a stretching surface in the presence of power heat flux and heat source. Shehzad et al. [4] obtained homotopy solutions for magnetohydrodynamic radiative flow of an incompressible Jeffrey fluid over a linearly stretched surface. In another investigation, Shehzad et al. [5] discussed the three-dimensional hydromagnetic flow of Jeffrey fluid with nanoparticles where the effects of thermal radiation and internal heat generation are considered. Hussain et al. [6] conducted heat and mass transfer analysis of two-dimensional hydromagnetic flow of an incompressible Jeffrey nanofluid over an exponentially stretching surface in the presence of thermal radiation, viscous dissipation, Brownian motion, and thermophoresis effects. Very recently, the influence of melting heat transfer and thermal radiation on MHD stagnation point flow of an electrically conducting Jeffrey fluid over a stretching sheet with partial surface slip has been analyzed numerically by Das et al. [7] with the help of Runge-Kutta-Fehlberg method.

Besides that, Jeffrey fluid also has been studied in peristalsis known as major mechanism of fluid transport especially in biological system, for example, urine transport from kidney to bladder through ureter, movement of chime in the gastrointestinal tract, the movement of spermatozoa in the ducts efferent of the male reproductive tract, ovum in the female fallopian tube, the locomotion

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Structural properties of heavy and superheavy nuclei in a semi-microscopic approach

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The structure of some heavy and superheavy nuclei with $93 \leq Z \leq 126$ and $130 \leq N \leq 252$ is studied using a semi-microscopic model. In this approach, the macroscopic energy part of the total energy of a nucleus is obtained from the Skyrme nucleon–nucleon interaction in the semi-classical extended Thomas–Fermi approach. The microscopic shell-plus pairing correction energies are calculated in Strutinsky's approach. Within this semi-microscopic approach, the total energy surfaces are investigated in multidimensional deformation space. For each nucleus, the model predictions for the binding energy, deformation energy, the deformation parameters and comparison with other theoretical models are presented. The proposed model shows a significant consistency with other models, and it is found to be successful in reproducing the structural properties of nuclei in heavy and superheavy region.

Keywords: Superheavy nuclei; shell-correction; binding energy.

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Tailoring the electrical and photo-electrical properties of a WS_2 field effect transistor by selective n-type chemical doping†

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Here, we demonstrate a doping technique which remarkably improves the electrical and photoelectric characteristics of a WS_2 field effect transistor (FET) by chemical doping. The shift of the threshold voltage towards a negative gate voltage and the red shift of the E^1_{2g} and A_{1g} peaks in the Raman spectra confirm the n-type doping effect in WS_2 FETs. WS_2 films show an unprecedented high mobility of 255 $cm^2\ V^{-1}\ s^{-1}$ at room temperature. The on/off ratio of the output current is $\sim 10^8$ at room temperature. The mobility of a multilayer ML-WS_2 FET was found to be 425 $cm^2\ V^{-1}\ s^{-1}$ at 5 K. Semiconductor-to-metal transitions were also observed at $V_{bg} > 30$ V. A decrease in contact and sheet resistance was observed after potassium iodide (KI) doping. The photocurrent in WS_2 FETs was also enhanced after n-type doping. Chemical doping exhibited a very stable, effective, and easy-to-apply method to enhance the performance of a WS_2 FET.

1. Introduction

Due to unique physical and electrical properties,[1,2] considerable interest has developed for two-dimensional (2D) atomic layered materials.[3,4] Graphene, an exemplary 2D carbon system with fascinating properties, which makes it a promising material in a variety of future nanoelectronics applications such as field effect transistors (FETs),[5] ultracapacitors, solar cells and especially as gas and chemical sensors.[6] Regardless of all its advantages in nanoelectronics device applications, graphene cannot be used as an active channel material in FETs due to the absence of a bandgap.[7] Considerable research efforts have been conducted to attain a significant bandgap in graphene like patterning into nanoribbons,[7] chemical functionalization,[8] and dual-gated bilayer graphene.[9] But it always shows bandgap *versus* significant mobility degradation with low on/off switching ratio for FETs.[10] Recently, the absence of a bandgap in graphene has encouraged researchers to search for other 2D layered materials.

2D tungsten disulphide (WS_2) is a tremendous material provoking as strong competitors for next-generation nanoelectronics and optoelectronics devices. WS_2 is of atomic-layer-thick that does have a bandgap.[11] It has specific interest due to transition of indirect-to-direct bandgap nature by changing number of layers and observation of photoluminescence (PL) in the visible range at room temperature.[12,13] Bulk WS_2 is an n-type semiconductor with an indirect-bandgap (1.4 eV), but turn into a direct-bandgap (2.1 eV) material when cleaved as monolayer.[14] WS_2 is 2D layered semiconductor material; it has been widely studied due to its attractive electrical and optical properties in a variety of applications.[15] Especially in the field of low power FET,[16] photodectors,[17] gas and chemical sensors,[18] memory and electroluminescent devices, and integrated circuits.[11,19]

Like other low-dimensional semiconductors transport properties of WS_2 are strongly degraded by the extrinsic/environmental effects, which limit their intrinsic properties and overall permanence.[20,21] It has been already exposed that the electrical and photoelectrical characteristics of a mechanically exfoliated WS_2 layer could be affected by the adsorbents in ambient air.[22] The improvement in sample quality is essential for the upcoming development of WS_2 device technology.[11] Recently, different strategies were used to improve the device performance by limiting the Schottky barrier height (SBH) by using different contact electrode,[23,24] and with different substrate to enhance charge carrier mobility.[25] Different doping techniques are used to control the carrier concentrations in 2D semiconductor materials.[26] The controlled doping of WS_2 layers is important for controlling the carrier concentrations, which has fundamental significance for FET devices. Such efforts are extremely crucial for WS_2-based FETs

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Network Selection and Channel Allocation for Spectrum Sharing in 5G Heterogeneous Networks

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ABSTRACT The demand for spectrum resources has increased dramatically with the advent of modern wireless applications. Spectrum sharing, considered as a critical mechanism for 5G networks, is envisioned to address spectrum scarcity issue and achieve high data rate access, and guaranteed the quality of service (QoS). From the licensed network's perspective, the interference caused by all secondary users (SUs) should be minimized. From secondary networks point of view, there is a need to assign networks to SUs in such a way that overall interference is reduced, enabling the accommodation of a growing number of SUs. This paper presents a network selection and channel allocation mechanism in order to increase revenue by accommodating more SUs and catering to their preferences, while at the same time, respecting the primary network operator's policies. An optimization problem is formulated in order to minimize accumulated interference incurred to licensed users and the amount that SUs have to pay for using the primary network. The aim is to provide SUs with a specific QoS at a lower price, subject to the interference constraints of each available network with idle channels. Particle swarm optimization and a modified version of the genetic algorithm are used to solve the optimization problem. Finally, this paper is supported by extensive simulation results that illustrate the effectiveness of the proposed methods in finding a near-optimal solution.

INDEX TERMS Channel allocation, network selection, 5G heterogeneous networks, optimization.

I. INTRODUCTION

The last decade has seen the dramatic increase in the demand of mobile data due to the increase in mobile devices and versatile applications. It is forecast that the data traffic will increase 10-fold between 2014 and 2019 [1]. This explosive demand of mobile data results in several challenges which shifted the research directions to fifth generation (5G) networks [2]. 5G networks are intended to provide significantly high data rate access and guaranteed quality-of-service (QoS). Thus, the demand of spectrum resources is expected to increase significantly in 5G networks. This requires wireless system designers to propose efficient spectrum management schemes. Different views on 5G architecture are presented in [3]–[5] with key technologies such as massive MIMO, energy efficient communications, cognitive radios, visible light communication, small cells, etc. In nutshell, 5G is visualized as heterogeneous networks which can provide access to a range of wireless networks and access technologies [6]. The 5G heterogeneous networks will mainly consist of network densification, i.e., densification over space and frequency. The dense deployment of small cells is called the densification over space whereas utilizing radio spectrum in diverse bands is called densification over frequency. Network densification can meet the demand of high capacity in 5G networks [7]. However, opportunistic spectrum sharing is important in order to achieve stringent goals of 5G in heterogeneous environment.

Spectrum sharing ensures the coverage of 5G heterogeneous networks everywhere and all the time. It can support a large number of connected devices and diverse applications [8]. In addition, it is spectrum efficient as it can use all non-contiguous spectrum, can achieve better system capacity, reduce energy consumption, and increase cell throughput. Dynamic spectrum access (DSA) has emerged as key for spectrum sharing in an opportunistic way [9], [10]. A radio network employing DSA to coexist with a licensed

A Survey on Power Gating Techniques in Low Power VLSI Design

G. Srikanth, Bhanu M. Bhaskara and M. Asha Rani

Abstract The most effective technique to reduce dynamic power is the supply voltage reduction by technology scaling which reduces threshold voltage. Under deep submicron technology, reduction in threshold voltage increases leakage currents, gate tunneling currents and leakage power in standby mode. Most of the handheld devices have long standby mode cause leakage current contributing to leakage power dissipation. In this paper, various leakage power reductions, charge recycling techniques, data retention of memories. Various Power gating techniques are discussed in detail.

Keywords Dynamic voltage and frequency scaling (DVFS) · Power gating (PG) · Multi-threshold CMOS (MTCMOS) · Dual-threshold CMOS (DTCMOS)

1 Introduction

The dynamic power (DP) in VLSI circuits depends on the clock frequency, capacitance and square of the supply voltage. The most effective technique to reduce DP is reducing the supply voltage by scaling the device. Supply voltage scaling increases the circuit delay and reduces threshold voltage, minimize

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Letter to Editor **Open Access**

BENEFITS VERSUS RISKS OF PROTON PUMP INHIBITORS: ARE WE OPENING THE CAN OF WORMS

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Sir,

Proton pump inhibitors (PPIs) are one of the most commonly used drugs worldwide They are indicated for treatment of Gastro-esophageal Reflux Disease (GERD), acid peptic disorders, stress ulcers and prophylaxis of NSAID induced ulcers.[1] PPIs are more efficacious than other drugs like histamine -2 receptor blockers for the treatment of these disorders.[1] Though PPIs are highly potent and effective acid suppressors they are often misused and prescribed irrationally.

The incidence of irrational use of PPIs varies from 40-70 % in different studies. [2] In one of our previous studies 58 % of PPIs prescriptions were irrational. [2] These findings become much more significant in the light of recent findings which suggest correlation of long term use of PPIs to myocardial infarction and kidney injury. [3,4] The PPIs may be deemed safe for short term use but chronic use carries risk of hip fractures, infection with *clostridium difficle*, community acquired pneumonia.[2] PPIs exposure in elderly population was also found to be associated with hyperparathyroidism in one recently conducted study.[5] The ongoing long term studies for assessing the safety and association of PPIs with various serious outcomes may open up a new can of worms.

Keeping in mind the benefits as well as risks of proton pump inhibitors, clinicians should judiciously use these drugs in practice. The patients should also be educated regarding the adverse outcomes of PPIs on long term therapy as these drugs are easily available without prescription.

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Optical limiting efficiency of an electroactive bis-iminopyridine ligand and its zinc complex

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Abstract—An electroactive based bis-iminopyridine ligand has been synthesized by a condensation reaction between (4-(6,7-dimethyldithio-tetrathiafulvalene)-aniline) with 2,6-diformylpyridine. The complexation of this ligand with $ZnCl_2$ afforded a tetrahedral neutral Zinc metal complex. Nonlinear optical measurements of these structures have given good results in a picosecond regime. The nonlinear absorption of the ligand was significantly enhanced upon complexation with $ZnCl_2$. This prompted us to conduct an experiment of optical limiting at wavelength 532nm. The nonlinear absorption properties of these structures were studied and compared to the reference material C_{60}.

Intensive studies of nonlinear optics (NLO) have been induced by expected applicability of their results in optics, telecommunications and information processing. In this regard, π-conjugated chromophores reveal good processibility, electronic and optical properties [1-4] including intrinsic hyperpolarizability of 3-dicyanomethylene-5,5-dimethyl-1-[2-(4-hydroxyphenyl) ethenyl]-cyclohexene nanocrystallites incorporated into the photopolymer matrices with high third order optical properties [5]. The delocalized π-electrons give rise to ultrafast response times and large optical nonlinearity, which makes these materials attractive candidates for optoelectronic and photonic applications in optical computing, logic devices, optical switching and organic solar cells [6-9]. We were interested in the π-conjugated "Push-pull" organic chromophores containing a tetrathiafulvalene electron donating group and an iminopyridyl accepting fragment that can also act as a coordinating unit. This type of compound is of great interest since it gives the possibility to obtain multifunctional materials which may represent an interaction between two or more physical properties, such as magnetism and conductivity [11-13]. Ligands such as iminopyridines have been chosen because of their ability to form a multitude of stable complexes and were, for example, used as catalysts for olefin polymerization [14-15]. In this work, we report on the optical limiting properties of an azo-based iminopyridine ligand and its associated zinc(II) complex.

The experiments were investigated by means of the Z-scan technique using 16ps mode-locked Nd:YAG lasers operating at 532nm at 10Hz. The details of the Z-scan technique and the procedure used for the determination of the NLO parameters have been described in details elsewhere [7]. Their nonlinear refractive and absorptive properties were measured and are compared with those of the C_{60} fullerene.

Different concentrations were investigated in order to study the effect of varying the concentration in the low and high excitation energy. Four concentrations (0.5mM, 1mM, 2mM and 1.5mm) were prepared for the ligand and the corresponding zinc(II) complex.

The structure of the ligand (1) is composed of an extended π-conjugated system that incorporates tetrathiafulvalene groups and a bis-iminopyridyl fragment. This composition leads to the establishment of an intramolecular charge transfer process between the donor groups and the accepting unit. This behavior makes these systems interesting in terms of nonlinear optical properties. Figure 1 shows the chemical structure of the ligand (1) and of the zinc(II) complex (2).

We started the experimental study exploring the field of linear absorption. For solubility reasons, dimethyl-formamide (DMF) was used as a solvent. We used a spectrophotometer UV-VIS-IR (Perkin Elmer Lambda 19) in the range of wavelengths between 250 and 800 nm [11].

The UV-Visible spectrophotometric titration studies of

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PERFORMANCE ANALYSIS OF A NEW WATER-BASED MICROCOOLING SYSTEM

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In the electronic industry, dissipating the heat load becomes a critical factor for highly developed designs. These require higher power transfer in a more compact size. In the current study, a new microcooling system was developed and tested. It utilizes the enhancement in heat transfer characteristics associated with implementing a vortex promoter in the evaporator segment of a water-based heat pipe. The test evaporator was a cavity of 4-mm diameter and 23-mm length in an electrically heated aluminum block. A helical coil (of various diameters, namely 500, 300, and 250 μm) was introduced to the evaporator segment to act as a vortex promoter. Configurations of a new microcooling system based on a modified heat pipe technology were built and tested. The presented system proves to work efficiently in situations where a closed-loop thermosyphon encounters film boiling limitation. The most efficient configuration has a flow modifier diameter about one-tenth of the evaporator chamber gap, while the diameter of the return line was three-quarters of the evaporator gap. This configuration shows a stable operation characteristic and possesses high thermal efficiency. The maximum heat flux obtained by such a configuration was 305 W/cm^2 when it runs at 103°C saturated temperature and 0.01°C/W thermal resistance. A uniform temperature distribution along the system was noticed.

Keywords microheat pipe, microchip cooling system, vortex promoter, film boiling, two-phase

INTRODUCTION

In the modern electronic industry, weight and space are at a premium. The new generation of high-capability electronic components is characterized by a high heat

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Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/ueht.

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A NOTE ON ENTROPY GENERATION IN MHD FLOW OVER A VERTICAL PLATE EMBEDDED IN A POROUS MEDIUM WITH ARBITRARY SHEAR STRESS AND RAMPED TEMPERATURE

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This note provides an exact analysis of unsteady free convection flow of viscous fluid past a vertical plate with arbitrary shear stress and ramped wall temperature. The fluid is considered to be electrically conducting and passing through a porous medium. Equations governing the problem are first written in dimensionless form and then solved for the exact solutions using the Laplace transform method. The graphs of velocity, entropy generation, and Bejan number are plotted for various parameters of interest. It is found that velocity and entropy generation decrease with increasing wall shear stress in cases of both ramped and constant wall temperature. It is also observed that Bejan number increases with increasing wall shear stress.

KEY WORDS: *wall shear stress, ramped temperature, MHD, porous medium, entropy generation, Bejan number*

1. INTRODUCTION

Magnetohydrodynamic (MHD) free convection flow of a viscous incompressible electrically conducting fluid in the presence of a transverse magnetic field in porous media is of much importance because it has many applications in plasma studies, cooling of nuclear reactors, thermal insulation, and heat transfer from pipes and transmission lines. Free convection flow of a viscous incompressible fluid through a porous medium bounded by an infinite vertical plate under the action of a magnetic field has been studied by Raptis and Kafousias (1982). MHD mixed convection from a vertical plate embedded in a porous medium was investigated by Aldoss et al. (1995). MHD free convection from a vertical plate embedded in a thermally stratified porous medium was investigated by Chamkha (1997). In the literature many studies deal with the free convection flow over a vertical plate when the velocity field is given on the boundary and exact solutions are obtained, whereas, there are only a few investigations where the shear stress at the boundary is prescribed; see, for example, Vieru et al. (2011) and Fetecau et al. (2011a,b). Fatecau et al. (2013a) established general solutions for MHD natural convection flow with radiative heat transfer and slip condition over a moving plate.

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Coefficient Estimates for Certain Subfamilies of Close-to-Convex Functions of Complex Order

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Abstract. Motivated from the recent work of Srivastava et al. (H.M. Srivastava, Qing-Hua Xu, Guang-Ping Wu, Coefficient estimates for certain subclasses of spiral-like functions of complex order, 23 (2010) 763-768), we aim to determine the coefficient estimates for functions in certain subclasses of close-to-convex and related functions of complex order, which are here defined by means of Sālāgean derivative operator and Cauchy-Euler type non-homogeneous differential equation. Several interesting consequences of our results are also observed.

1. Introduction

Let $\mathcal{A}$ denote the class of function $f(z)$:

$$f(z) = z + \sum_{j=2}^{\infty} a_j z^j, \tag{1}$$

which are analytic in the unit disk $E = \{z : |z| < 1\}$. Let f and g be analytic in E, we say that f is subordinate to g, written as $f(z) \prec g(z)$ if there exists a Schwarz function w, which is analytic in E with $w(0) = 0$ and $|w(z)| < 1$ $(z \in E)$, such that $f(z) = g(w(z))$. In particular, when g is univalent, then the above subordination is equivalent to $f(0) = g(0)$ and $f(E) \subseteq g(E)$, see [7]. Also let $S^*(\gamma)$, $C(\gamma)$, $K(\gamma)$ and $Q(\gamma)$ be the subclasses of $\mathcal{A}$ consisting of all functions which are starlike, convex, close-to-convex and quasi convex of complex order γ $(\gamma \neq 0)$ respectively, for details see [1, 9–12]. We note that for $0 < \gamma \leq 1$, these classes coincide with the well known classes of starlike, convex , close-to-convex and quasi convex of order $1 - \gamma$.

Sālāgean [14] introduced the operator $D^n (n \in N_0)$ which is also called Sālāgean derivative operator and is defined as:

$D^0 f(z) = f(z)$ and $D^1 f(z) = zf'(z)$,

and, in general,

$D^n f(z) = D(D^{n-1} f(z))$ $(n \in N)$

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Research Article

Nonexistence of global weak solutions of a system of wave equations on the Heisenberg group

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Abstract

Sufficient conditions are obtained for the nonexistence of solutions to the nonlinear higher order pseudo-parabolic equation

$$u_{tt} - \Delta_{\mathbb{H}} u + (-\Delta_{\mathbb{H}})^{\delta/2} u = f(\eta, t) u^p, \quad (\eta, t) \in \mathbb{H} \times (0, \infty),\ p > 1,\ u \geq 0,$$

where $\Delta_{\mathbb{H}}$ is the Kohn–Laplace operator on the $(2N+1)$-dimensional Heisenberg group $\mathbb{H}$ and $f(\eta, t)$ is a given function. Then, this result is extended to the case of a 2×2-system of the same type. Our technique of proof is based on a duality argument.

Keywords: Nonexistence, nonlinear hyperbolic equation, systems of hyperbolic equations, Heisenberg group.
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1. Introduction and preliminaries

In this paper, we are first concerned with the nonexistence of global weak solutions to the nonlinear hyperbolic equation

$$u_{tt} - \Delta_{\mathbb{H}} u + (-\Delta_{\mathbb{H}})^{\frac{\delta}{2}} u = f(\eta, t) u^p, \quad (\eta, t) \in \mathbb{H} \times (0, \infty),\ p > 1,\ u \geq 0, \tag{1.1}$$

equipped with the initial conditions

$$u(\eta, 0) = u_0(\eta),\ u_t(\eta, 0) = u_1(\eta),\ \eta \in \mathbb{H}, \tag{1.2}$$

where $(-\Delta_{\mathbb{H}})^{\delta/2}$, $0 < \delta < 2$ is the fractional power of the Kohn–Laplace operator $\Delta_{\mathbb{H}}$ on the $(2N+1)$-

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Application of chlorine-36 technique in determining the age of modern groundwater in the Al-Zulfi province, Saudi Arabia

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The present study aims to estimate the residence time of groundwater based on bomb-produced ^{36}Cl. ^{36}Cl/Cl ratios in the water samples are determined by inductively coupled plasma mass spectrometry and liquid scintillation counting. ^{36}Cl/Cl ratios in the groundwater were estimated to be 1.0–2.0 $\times$ 10^{-12}. Estimates of residence time were obtained by comparing the measured bomb-derived ^{36}Cl concentrations in groundwater with the background reference. Dating based on a ^{36}Cl bomb pulse may be more reliable and sensitive for groundwater recharged before 1975, back as far as the mid-1950s. The above ^{36}Cl background concentration was deduced by determining the background-corrected Dye-3 ice core data from the frozen Arctic data, according to the estimated total ^{36}Cl resources. The residence time of 7.81 $\times$ 10^4 y is obtained from extrapolated groundwater flow velocity. ^{36}Cl concentration in groundwater does not reflect the input of bomb pulse ^{36}Cl, and it belongs to the era before 1950.

Keywords: aquifer; chlorine-36; environmental radioactive tracer; groundwater dating; ICP-MS; LSC; Saudi Arabia

1. Introduction

In Saudi Arabia, citizens usually use groundwater as a main source of washing water in houses, cities as well as for irrigation in farms. The wells that supply the Al-Zulfi (sometimes called Az-Zulfi) province with groundwater may differ. They depend on the situation of the wells and the nature of their basins, and the surrounding sources that replenish them from seasonal rainfall through surroundings, mountains and valleys. We have to know how long the recovery of these well resources will take to be accomplished. The Al-Zulfi province is situated at the bottom of a valley between two huge dunes of red sands of special composition. The mountains surrounding this valley have major effects on replenishing its groundwater aquifer. Our objective in this work is to give a complete overview of the age of groundwater in the Al-Zulfi province, communicating the selective isotopic ratios of ^{36}Cl/Cl, which can be helpful in providing information about the groundwater age and its replenishing rate [1]. Previously, ^{3}H/^{3}He ratios were used to determine the groundwater age. Since large quantities of ^{3}H were produced during atmospheric thermonuclear testing, ^{3}H concentrations in precipitation reached a peak around 1963, resulting in a bomb pulse in the hydrological cycle. Due to the relatively short half-live of tritium (^{3}H; 12.33 years) compared to other radiotracers, it has been one of the most useful environmental

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Unsteady Free Convection Flow of Rotating MHD Second Grade Fluid in a Porous Medium over an Oscillating Plate

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Abstract. In this paper, the analytical solutions for unsteady free convection flow of rotating second grade fluid over an isothermal oscillating vertical plate are obtained. The effect of magnetohydrodynamics (MHD) flow in a porous medium is also considered. The governing equation for momentum is modelled in a rotating system such that both fluid and plate rotate in unison with uniform angular velocity. This phenomenon is modelled in the form of partial differential equations together with initial and boundary conditions. Some suitable non-dimensional variables are introduced. The corresponding non-dimensional momentum and energy equations with conditions are solved using Laplace transform technique. Expression for velocity and temperature fields are obtained and displayed graphically for different values of second grade fluid (α), rotation (b), magnetic (M) and porosity (K) parameters. Results obtained satisfied all the initial and boundary conditions.

INTRODUCTION

The study of magnetohydrodynamics (MHD) second grade fluid through a porous medium has attracted the attentions of many researchers. This is due to its engineering and industrial applications such as food processing and polymer production [1-9]. Hayat *et al.* [10] has investigated the electrical conducting of second grade fluid through a porous space. This problem has been solved analytically by using Homotopy Analysis Method (HAM). The stretching sheet of the plate also considered in this problem which exhibit the slip condition for boundary condition of momentum equation. The analytical solutions for MHD flows of second grade fluid embedded in a porous medium also studied by Khan *et al.* [11]. But, in their research, the solutions of the problem have been obtained by using method of Fourier Sine transform. Validation of the solution is discussed as limiting cases by considering second grade parameter is equal to zero which similar to the solution of Newtonian fluid. Samiulhaq *et al*. [12] has contributed a new problem of unsteady free convection flow of second grade fluid with the effect of MHD flows and porous medium. Difference with Hayat *et al.* [10] and Khan *et al.* [11], Laplace transform method was used by these researchers. Two cases of thermal conditions have been discussed in this problem, which are isothermal and ramped wall temperatures. Nowadays, the study of free convection flows in rotating fluid phenomena has been studied by several authors in their research [13-14]. Mohamad *et al.* [15] and Ismail *et al.* [16] have solved the problem of rotating second grade fluid in the presence of heat transfer effect. Laplace transform method has been used in order to obtain the exact solutions of momentum and energy equations. Furthermore, it is found from the literature that investigations on fluid flow problems are also available with different boundary condition such as oscillatory flow which is known as Stokes' second problem [17-22]. Motivated by previous studies of rotating MHD flow in porous medium, we are interested to tackle the problem of unsteady free convection flow of rotating MHD second grade fluid in porous medium over an oscillating plate. The governing equations of this problem will be solved by using Laplace transform technique.

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Thermal Radiation in Unsteady MHD Free Convection Flow of Jeffrey Fluid with Ramped Wall Temperature

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Abstract. This research studies the influence of thermal radiation in unsteady magnetogydrodynamic (MHD) free convection flow of Jeffrey fluid with ramped wall temperature. The fluid is taken as electrically conducting under the action of a magnetic field applied in a direction perpendicular to the flow. The problem is modelled in terms of partial differential equations with some physical conditions. Appropriate dimensionless variables are employed to the governing equations and solved numerically using Finite Difference Method (FDM). Numerical results for velocity and temperature profiles are obtained in various graphs and discussed in details for embedded flow parameters. On one hand, it is found that velocity increases with increasing Grashof number, radiation parameter and time for both ramped and isothermal wall temperature. On the other hand, increasing Prandtl number, Hartmann number and material parameter of Jeffrey fluid decreases fluid velocity. Besides that, increasing Prandtl number tends to decrease the thermal boundary layer thickness whereas it decreases with increasing radiation parameter.

INTRODUCTION

The studies of non-Newtonian fluids have increased considerably in past few decades due to their industrial and technological applications. Examples of non-Newtonian fluids include all the high viscosity liquids as well as a polymer solution, molten polymers, many solid suspensions, blood, colloids, gel, concentrated slurries and also the solutions of macromolecules. One of the subclasses of non-Newtonian fluid which has attracted the attention of many researchers is the Jeffrey fluid. This fluid is relatively simpler viscoelastic non-Newtonian fluid model that exhibits both relaxation and retardation effects [1].

Many numerical and analytical investigations on Jeffrey fluid have been carried out. Amongst them, Hayat et al. [2] investigated the effect of thermal radiation on the unsteady mixed convection flow of a Jeffrey fluid past a porous vertical stretching surface using homotopy analysis method (HAM). In another investigation, Hayat et al. [3] considered similar effects of thermal radiation and porous medium to examine the flow of an incompressible Jeffrey fluid over a stretching surface together with power law heat flux and heat source. Meanwhile, a comprehensive discussion of thermal radiation to investigate the hydromagnetic flow of an incompressible Jeffrey nanofluid over an exponentially stretching surface is reported by Hussain et al. [4]. They also considered the viscous dissipation, Brownian motion and also thermophoresis effects in their study. The influence of melting heat transfer and thermal radiation on MHD stagnation point flow of an electrically conducting Jeffrey fluid over a stretching sheet with partial surface slip is performed by Das et al. [5]. Shehzad et al. [6] investigated the influence of thermophoresis and joule heating on the radiative flow of Jeffrey fluid with mixed convection.

Besides that, in references [7-11] some interesting studies on the peristaltic flow of a Jeffrey fluid in the presence of magnetic field have been reported. Idowu et al. [12] proposed the effect of heat and mass transfer on unsteady MHD oscillatory flow of Jeffrey fluid in the horizontal channel with chemical reaction. Moreover, the flow of Jeffrey fluid between two torsionally oscillating disks is studied by Reddy et al. [13]. Then, Kavita et al. [14]

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Comparative Studies on Different Nanofiber Photocatalysts for Water Splitting

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ABSTRACT

Water splitting using photocatalyst has become a topic of recent investigation since it has the potential of producing hydrogen for clean energy from sunlight. An extensive number of solid photocatalysts have been studied for overall water splitting in recent years. In this study, two methods were employed to synthesize two different photocatalysts for water splitting. The first method describes the synthesis of nickel oxide-loaded strontium titanate ($NiO\text{-}SrTiO_3$) particles on electrospun polyacrylonitrile (PAN) nanofibers incorporated with graphene nanoplatelets for water splitting. The electrospun PAN fibers were first oxidized at 270°C for two hours and subsequently immersed in a solution containing ethanol, titanium (IV)-isopropoxide [$C_{12}H_{28}O_4Ti$] and strontium nitrate [$Sr(NO_3)_2$]. This solution was then treated with NiO nanoparticles dispersed in toluene. The surface treated PAN fibers were annealed at 600°C in air for 1 hour to transform fibers into a crystalline form for improved photocatalyst performance. In the second method, coaxial electrospinning process was used to produce core/shell strontium titanate/nickel oxide ($SrTiO_3$-NiO) nanofibers. In coaxial method, poly (vinyl pyrrolidone) (PVP) was dissolved in deionized (DI) water, and then titanium (IV) isopropoxide [$C_{12}H_{28}O_4Ti$] and strontium nitrate [$Sr(NO_3)_2$] were added into the solution to form the inner (core) layer. For outer (shell) solution, polyacrylonitrile (PAN) polymer was dissolved in dimethylformamide (DMF) at a weight ratio of 10:90 and then nickel oxide was mixed with the solution. Ultraviolet (UV) spectrophotometry and static contact angle measurement techniques were employed to characterize the structural properties of photocatalysts produced by both methods and a comparison was made between the two photocatalysts. The morphology and diameter of the nanofibers were observed by scanning electron microscopy (SEM). The structure and crystallinity of the calcined nanofibers were also observed by means of X-ray diffraction (XRD).

Keywords: Water Splitting, Electrospinning, Semiconductor Photocatalysts, Strontium Titanata, NiO Nanoparticles.

1. INTRODUCTION

Hydrogen is being considered a clean energy source and a possible alternative to exhaustible fossil fuels [1]. For the transition from fuel-based economy to green energy based-economy, hydrogen production using renewable energy has become an important focus of attention these days [1-2]. Water splitting using photocatalysts under solar irradiation has become a major method of hydrogen production. Water splitting into hydrogen and oxygen has long been considered a great idea. There is an urgent need for a renewable energy source, since the fossil fuels reserve are depleting at an alarming rate throughout the world. Research into the decomposition of water into hydrogen and oxygen using an appropriate photocatalyst was re-invigorated by the preliminary work of Fujishima and Honda [3-5]. The most important aspect of this work is to find suitable photocatalysts having suitable bandgap energy for efficient water splitting. Overall, water splitting for large-scale production of hydrogen using a photocatalyst has been under extensive research since the 1980s [4].

During the 1970s and 1980s, the photocatalysts used in research for water splitting applications were TiO_2 and $SrTiO_3$ [6]. In late 1980s, new photocatalysts having unique structures such as $K_4Nb_6O_{17}$, $BaTi_4O_9$ and

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APPLICATION OF HARDY TOEPLITZ OPERATORS ON THE SPACE OF ANALYTIC FUNCTIONS OF BOUNDED MEAN OSCILLATION IN THE UNIT BALL

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Abstract. In this paper, we characterize complex measures μ on the unit ball for which the Toeplitz operator T_μ is bounded or compact on the space of holomorphic functions in the unit ball $\mathbb{B}_n$ that have bounded mean oscillation with respect to the Bergman projection and the Bergman metric. Application to the Hankel operators are indicated.

1. Introduction

Through this paper, $\mathbb{B}_n$ is the unit ball of the n-dimensional complex Euclidean space $\mathbb{C}^n$ and dV is the Lebesgue volume measure on $\mathbb{C}^n$, normalized so that $V(\mathbb{B}_n) \equiv 1$. Also $\mathbb{S}_n$ is the boundary of $\mathbb{B}_n$ and $d\sigma$ be the surface measure on $\mathbb{S}_n$. Once again, we normalize σ so that $\sigma(\mathbb{B}_n) \equiv 1$. We denote the class of all holomorphic functions on the unit ball $\mathbb{B}_n$ by $\mathcal{H}(\mathbb{B}_n)$.

As usual, the letter C will denote a positive constant, possibly different on each occurrence. We will say that the expressions A and B are equivalent, and write $A \approx B$, whenever there exist a positive constant C such that $\frac{1}{C}A \leq B \leq CA$.

For any $\mathbf{z} = (z_1, z_2, \ldots, z_n), \mathbf{w} = (w_1, w_2, \ldots, w_n) \in \mathbb{C}^n$, the inner product is defined by $\langle \mathbf{z}, \mathbf{w} \rangle = z_1\overline{w}_1 + \ldots + z_n\overline{w}_n$, and write $|\mathbf{z}| = \sqrt{\langle \mathbf{z}, \mathbf{z} \rangle}$.

For $f \in \mathcal{H}(\mathbb{B}_n)$, its complex gradient and radial derivative are defined by

$$\nabla f(\mathbf{z}) = \left(\frac{\partial f(\mathbf{z})}{\partial z_1}, \ldots, \frac{\partial f(\mathbf{z})}{\partial z_n} \right), \qquad \Re f(\mathbf{z}) = \langle \nabla f, \overline{\mathbf{z}} \rangle = \sum_{j=1}^{n} z_j \frac{\partial f(\mathbf{z})}{\partial z_j}.$$

For every point $\mathbf{a} \in \mathbb{B}_n$, the Möbius transformation $\varphi_\mathbf{a} : \mathbb{B}_n \to \mathbb{B}_n$ is defined by

$$\varphi_\mathbf{a}(\mathbf{z}) = \frac{\mathbf{a} - P_\mathbf{a}(\mathbf{z}) - S_\mathbf{a} Q_\mathbf{a}(\mathbf{z})}{1 - \langle \mathbf{z}, \mathbf{a} \rangle}, \quad \mathbf{z} \in \mathbb{B}_n,$$

where $S_\mathbf{a} = \sqrt{1 - |\mathbf{a}|^2}, P_\mathbf{a}(\mathbf{z}) = \frac{\mathbf{a}\langle \mathbf{z}, \mathbf{a} \rangle}{|\mathbf{a}|^2}, P_0 = 0$ and $Q_\mathbf{a} = I - P_\mathbf{a}$ (see for example [8, 14]).

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Key words and phrases. Toeplitz operators, BMOA spaces, Bergman projection, Hankel operator.

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Ingenol Mebutate 150 mg as Physician-Directed Treatment of Bowen's Disease Under Occlusion

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Key Words
Ingenol mebutate · Bowen's disease · Photodynamic therapy

Abstract
Ingenol mebutate (IM) is a topical pharmacotherapy approved in Switzerland since 2012 for treating non-hypertrophic, non-hyperkeratotic actinic keratosis. We report a case with off-label use of IM where Bowen's disease has been successfully treated with physician-directed IM 0.015% gel under occlusion over the chest area.

Introduction

Bowen's disease is an in-situ squamous cell carcinoma of the skin with approximately 3–5% of risk of progression to invasive carcinoma [1]. Although surgical excision is the definitive treatment, non-surgical treatment modalities including photodynamic therapy, 5-fluorouracil and imiquimod are effective alternatives for Bowen's disease, especially in patients who are poor candidates for surgery [2]. Judging by clinical experience, Bowen's disease is harder to treat than actinic keratosis. We herein report a case of Bowen's disease successfully treated with physician-directed ingenol mebutate (IM) 0.015% gel under occlusion over the chest area.

Case Report

We describe the case of a 82-year-old Caucasian man, Fitzpatrick skin type II, followed up at our clinic for a history of severe sun-damaged skin, actinic keratosis and multiple keratinocyte skin cancers.

The patient presented with 4 shiny red, well-demarcated plaques with/without scaling on the chest. Dermoscopy showed a clear pattern of dotted vessels. Based on the clinical and the dermatoscopical appearance of the lesions, a diagnosis of multiple Bowen's disease was made (fig. 1).

Based on the patient's preference for non-surgical treatment, we presented him with different topical treatment options. As the mobility of his hands was limited following orthopedic surgery, a physician-directed treatment was needed. Photodynamic therapy was declined by the patient on account of the expected pain associated with the procedure. Cryotherapy was deemed less suitable due to the number of lesions and potentially long wound healing. We decided to use IM as a physician-directed treatment, employing an occlusive dressing to enable a single application to elicit a thera-

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INVITED EDITORIAL

A researcher's ethical dilemma: Is self-plagiarism a condemnable practice or not?

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Plagiarism is defined as a form of misconduct which involves copying or stealing others' ideas, methods, findings, or words and passing off as one's own original work without acknowledging the original source (Office of Research Integrity, 2000). However, reusing one's own previously published work in subsequent publications without acknowledging this may be considered as self-plagiarism, a form of plagiarism that is of particular concern in the field of academic and research publications (Bird, 2002; Bonnell et al, 2012; Samuelson, 1994). Many a researcher, whether novice or expert, may be guilty of self-plagiarism at one time or other, even if unintentionally (Collberg and Kobourov, 2005). Although honest errors are not necessarily considered as research malpractice (Office of Research Integrity, 2000), any deliberate effort to deceive editors, reviewers, and readers by recycling and presenting old information as new is likely to be interpreted as an act of academic fraud (Bonnell et al, 2012). Part of the problem may be that academic authors fail to fully grasp the issue of publishers' copyright infringement.

In the current academic climate, academics are under pressure to increase their research and publication output in high-ranking journals in order to build their academic reputations; to foster the advancement of their academic departments and professions; and to gain access to research funding and promotion. This could potentially lead to a rise in self-plagiarism, intentional or otherwise.

Types of self-plagiarism range from deliberate fraud to forms that could be construed as inadvertent. Based on the guidelines from the Committee on Publication Ethics (COPE), self-plagiarism has been classified into four categories (Roig, 2010, Šupak-Smolčić and Bilić-Zulle, 2013): (1) Text recycling: Text recycling refers to cloning of larger sections of one's previously published text in a subsequent paper; (2) Redundant publication: This occurs when covert duplicate publication of one's own work appears in two or more journals with the same data, results, and discussion, with or without editing; (3) Augmented publication: This is a new paper resulting from the addition of new data to previously published data; and (4) Segmented publication: Segmented publication, known also as salami-slicing, occurs when the results derived for one experiment are published as two or more papers, thereby preventing the readers from obtaining a wider understanding of the overall experiment in a single paper. While any form of self-plagiarism can be practiced deliberately, it is certainly possible for researchers who contribute to numerous papers to inadvertently use some of their previously published text/words/ideas again in subsequent publication(s), a practice termed cryptomnesia (Carpenter, 2002).

Self-plagiarism is more common than thought, as demonstrated by the results of recent studies. Bretag and Carapiet (2007) found that 60% of academic researchers included in their preliminary investigation (n = 10) self-plagiarized by reusing their own previously published text in at least one of their articles. Furthermore, 11% of the manuscripts submitted between 2009 and 2010 to the *Croatian Medical Journal* were found to be plagiarized, with self-plagiarism accounting for 3% of these. In the plagiarized articles, plagiarism detected in the results (23%) and discussion (26%) sections was less when compared to the methods section (61%) (Baždarić, Bilić-Zulle, Brumini, and Petrovečki, 2012).

The problem has been recognized among university students too. A study in Europe (Pupovac, Bilic-Zulle, and Petrovecki, 2008) revealed that 35% of students from some universities in the United Kingdom (UK) indulged in self-plagiarism at least once, and more than half of them considered self-plagiarism to be justified

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Antimicrobial Original Research Paper

Characterization of carbapenem-resistant Gram-negative bacteria from Tamil Nadu

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Carbapenem resistance is disseminating worldwide among Gram-negative bacteria. The aim of this study was to identify carbapenem-resistance level and to determine the mechanism of carbapenem resistance among clinical isolates from two centres in Tamil Nadu. In the present study, a total of 93 Gram-negative isolates, which is found to be resistant to carbapenem by disk diffusion test in two centres, were included. All isolates are identified at species level by 16S rRNA sequencing. Minimal inhibitory concentrations (MICs) of isolates for Meropenem were tested by agar dilution method. Presence of bla_{OXA}, bla_{NDM}, bla_{VIM}, bla_{IMP} and bla_{KPC} genes was tested by PCR in all isolates. Amplicons were sequenced for confirmation of the genes. Among 93 isolates, 48 (%52) were *Escherichia coli*, 10 (%11) *Klebsiella pneumoniae,* nine (%10) *Pseudomonas aeruginosa*. Minimal inhibitory concentration results showed that of 93 suspected carbapenem-resistant isolates, 27 had meropenem MICs ≥ 2 μg/ml. The MIC range, MIC50 and MIC90 were <0.06 to >128 μg/ml, 0.12 and 16 μg/ml, respectively. Among meropenem-resistant isolates, *E. coli* were the most common (9/48, 22%), followed by *K. pneumoniae* (7/9, 77%), *P. aeruginosa* (6/10, 60%), *Acinetobacter baumannii* (2/2, 100%), *Enterobacter hormaechei* (2/3, 67%) and one *Providencia rettgeri* (1/1, 100%). PCR results showed that 16 of 93 carried bla_{NDM}, three *oxa181*, and one *imp4*. Among bla_{NDM} carriers, nine were *E. coli*, four *Klebsiella pneumoniae*, two *E. hormaechei* and one *P. rettgeri*. Three *K. pneumoniae* were OXA-181 carriers. The only *imp4* carrier was *P. aeruginosa*. A total of seven carbapenem-resistant isolates were negatives by PCR for the genes studied. All carbapenem-resistance gene-positive isolates had meropenem MICs >2 μg/ml. Our results confirm the dissemination of NDM and emergence of OXA-181 beta-lactamase among Gram-negative bacteria in South India. This study showed the emergence of NDM producer in clinical isolates of *E. hormaechei* and *P. rettgeri* in India.

Keywords: Meropenem, Carbapenem resistance, Gram-negative bacteria, NDM, OXA, ERIC-PCR

Introduction

Antibiotic resistance has become one of the most serious problems and concerns around the globe in recent past. Carbapenems are a class of β-lactam antibiotics, which are one of the antibiotics of last resort for bacterial infections due to Gram-negative bacteria including *Escherichia coli* and *K. pneumoniae* causing serious nosocomial infections.[1] Before 2000, only few of the clinical isolates were carbapenem resistant, which includes *Pseudomonas aeruginosa* and some *Acinetobacter baumannii*, due to the combination of high-level β-lactamase expression coupled with decreased permeability of the outer membrane or hyperexpression of efflux pumps.[2] So, carbapenem resistance was not considered as a major health problem before 2000, but since then, it became a major clinical health issue. Since US FDA approved imipenem and meropenem in 1985 and 1996, respectively, there was a notable 15–20 years where carbapenem resistance was developed in most of the microorganisms and similar relationship has been observed for other antibiotic classes as well.[3] There was a major threat to the antibiotic era since the emergence of acquired carbapenem-hydrolysing β-lactamases (carbapenemases) from most of the major nosocomial bacteria, such

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Maximum Principle and Existence of Weak Solutions for Nonlinear System Involving Singular *(p,q)*-Laplacian Operators

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Abstract.
We investigate in this work necessary and sufficient conditions for having the maximum principle for nonlinear system involving singular (p,q)-Laplacian operators on bounded domain Ω of R^n. Moreover, we prove the existence of positive weak solutions by the Browder theorem method for the considered system.

2010 Mathematics Subject Classification: 35B50, 35D3 0, 35J92.
Key words and phrases: Maximum principle; weak solution; singular p-Laplacian.

1 Introduction:

Let us consider the following nonlinear system

$$\left.\begin{aligned} -\operatorname{div}[|x|^{-rp}|\nabla u|^{p-2}\nabla u] &= a|x|^{-(r+1)p+\gamma}|u|^{p-2}u + b|u|^{\alpha}|v|^{\beta}v + f \quad \text{in } \Omega,\\ -\operatorname{div}[|x|^{-sq}|\nabla v|^{q-2}\nabla v] &= c|u|^{\alpha}|v|^{\beta}u + d|x|^{-(s+1)q+\delta}|v|^{q-2}v + g \quad \text{in } \Omega,\\ u = v &= 0 \quad \text{on } \partial\Omega, \end{aligned}\right\} \tag{1.1}$$

where Ω is a bounded domain of R^n with boundary $\partial\Omega$, $0 \in \Omega$, $1 < p, q < n$, $0 \le r \le \frac{n-p}{p}$, $0 \le s \le \frac{n-q}{q}$, $a, b, c, d, \alpha, \beta, \gamma, \delta$ are positive constants, f, g are given functions. The feature that needs to be highlighted in system (1.1) is the singularity in the weights. Due to this singularity in the weights, the extensions are challenging and nontrivial. A crucial milestone in the understanding of the elliptic problems involving the singular quasilinear elliptic operator $-\operatorname{div}[|x|^{-rp}|\nabla u|^{p-2}\nabla u]$ is the paper by Caffarelli, Kohn and Nirenberg [4] (see also [5, 16, 18]).

Many works have been devoted to the study of maximum principle for nonlinear systems either on a bounded domain (cf. [3, 9, 10]) or an unbounded domain (cf. [6, 8, 14]).

Jurnal Teknologi

Full Paper

UNSTEADY HEAT TRANSFER FLOW OF A CASSON FLUID WITH NEWTONIAN HEATING AND THERMAL RADIATION

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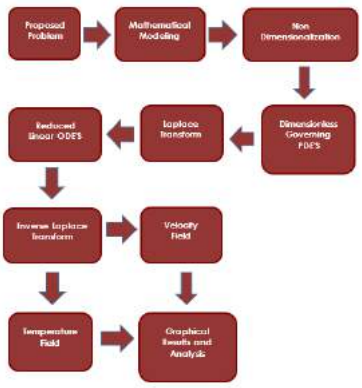

Abstract

This study investigates the unsteady heat transfer flow of a non-Newtonian Casson fluid over an oscillating vertical plate with Newtonian heating on the wall under the effects of thermal radiation. With the help of non-dimensional variables, governing equations are written into dimensionless form and then solved analytically by Laplace transform technique to find the solutions of temperature and velocity. The corresponding solutions of Nusselt number and skin friction are also calculated. The solution in term of viscous fluid is recovered as a limiting case of this work. The effects of the pertinent parameters on temperature and velocity are presented graphically and discussed details in this paper.

Keywords: Heat transfer; laplace transforms; newtonian heating; radiation effects

1.0 INTRODUCTION

During the last few years, the study of non-Newtonian fluids has got the attention of several authors because of its many applications in engineering and industry. For example, in process of plastic sheets, glass fiber production, movement of lubricants and biological fluids. The mathematical models for non-Newtonian fluid flows are non-linear and more complicated compared to classical Newtonian (Navier-Stokes) model. Due to the diversity in the physical structure of non-Newtonian fluids, several models have been developed in the previous published paper [1-4]. Amongst them, one of the most popular recently which accounts the rheological effects of an isotropic, incompressible and structure-based fluid is called Casson model. Casson [5] pioneered this model for the flow of pigment-oil suspensions. This model in fact is a plastic fluid and require a critical shear stress (greater than the yield stress) to overcome before fluid

Unsteady Free Convection Flow of Rotating MHD Second Grade Fluid in a Porous Medium over an Oscillating Plate

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Abstract. In this paper, the analytical solutions for unsteady free convection flow of rotating second grade fluid over an isothermal oscillating vertical plate are obtained. The effect of magnetohydrodynamics (MHD) flow in a porous medium is also considered. The governing equation for momentum is modelled in a rotating system such that both fluid and plate rotate in unison with uniform angular velocity. This phenomenon is modelled in the form of partial differential equations together with initial and boundary conditions. Some suitable non-dimensional variables are introduced. The corresponding non-dimensional momentum and energy equations with conditions are solved using Laplace transform technique. Expression for velocity and temperature fields are obtained and displayed graphically for different values of second grade fluid (α), rotation (b), magnetic (M) and porosity (K) parameters. Results obtained satisfied all the initial and boundary conditions.

INTRODUCTION

The study of magnetohydrodynamics (MHD) second grade fluid through a porous medium has attracted the attentions of many researchers. This is due to its engineering and industrial applications such as food processing and polymer production [1-9]. Hayat *et al.* [10] has investigated the electrical conducting of second grade fluid through a porous space. This problem has been solved analytically by using Homotopy Analysis Method (HAM). The stretching sheet of the plate also considered in this problem which exhibit the slip condition for boundary condition of momentum equation. The analytical solutions for MHD flows of second grade fluid embedded in a porous medium also studied by Khan *et al.* [11]. But, in their research, the solutions of the problem have been obtained by using method of Fourier Sine transform. Validation of the solution is discussed as limiting cases by considering second grade parameter is equal to zero which similar to the solution of Newtonian fluid. Samiulhaq *et al*. [12] has contributed a new problem of unsteady free convection flow of second grade fluid with the effect of MHD flows and porous medium. Difference with Hayat *et al.* [10] and Khan *et al.* [11], Laplace transform method was used by these researchers. Two cases of thermal conditions have been discussed in this problem, which are isothermal and ramped wall temperatures. Nowadays, the study of free convection flows in rotating fluid phenomena has been studied by several authors in their research [13-14]. Mohamad *et al.* [15] and Ismail *et al.* [16] have solved the problem of rotating second grade fluid in the presence of heat transfer effect. Laplace transform method has been used in order to obtain the exact solutions of momentum and energy equations. Furthermore, it is found from the literature that investigations on fluid flow problems are also available with different boundary condition such as oscillatory flow which is known as Stokes' second problem [17-22]. Motivated by previous studies of rotating MHD flow in porous medium, we are interested to tackle the problem of unsteady free convection flow of rotating MHD second grade fluid in porous medium over an oscillating plate. The governing equations of this problem will be solved by using Laplace transform technique.

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Jurnal Teknologi

Full Paper

EFFECTS OF NEWTONIAN HEATING AND MASS DIFFUSION ON MHD FREE CONVECTION FLOW OVER VERTICAL PLATE WITH SHEAR STRESS AT THE WALL

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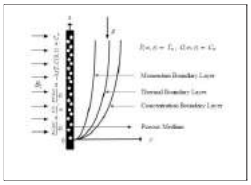

Abstract

Effects of Newtonian heating and mass diffusion on magnetohydrodynamic free convection flow over a vertical plate that applies arbitrary shear stress to the fluid is studied. The fluid is considered electrically conducting and passing through a porous medium. The influence of thermal radiation in the energy equations is also considered. General solutions of the problem are obtained in closed form using the Laplace transform technique. They satisfy the governing equations, initial and boundary conditions and can set up a huge number of exact solutions correlatives to various fluid motions. The effects of various parameters on velocity profiles are shown graphically and discussed in details.

Keywords: Free convection; mass diffusion; Newtonian heating; MHD; shear stress; laplace transform

Abstrak

Kesan pemanasan Newtonan dan resapan jisim pada aliran olakan bebas hidrodinamik magnet ke atas plat menegak di dalam bendalir yang dikenakan tegasan ricih sembarangan dikaji. Bendalir ini dipertimbangkan sebagai pengalir elektrik dan melintasi suatu bahantara berliang. Pengaruh sinaran haba di dalam persamaan tenaga juga dipertimbangkan. Penyelesaian am dalam bentuk tertutup bagi masalah ini diperoleh dengan menggunakan kaedah penjelmaan Laplace. Penyelesaian ini telah memenuhi persamaan tertakluk, syarat awal dan syarat sempadan dan boleh menyediakan sebilangan besar penyelesaian bagi pelbagai gerakan bendalir yang berkaitan. Kesan dari pelbagai parameter ke atas profil halaju dipaparkan secara graf dan dibincangkan dengan terperinci.

Kata kunci: Olakan bebas; resapan jisim; pemanasan Newtonan; hidrodinamik magnet; tegasan ricih; penjelmaan laplace

1.0 INTRODUCTION

Generally, the heat and mass transfer together with free convection flows are gradually becoming the main focus of attention not only in the field of fluid dynamics but also in several other disciplines. Perhaps, it is due to their several important applications in various branches of engineering and industrial activities such as food processing and polymer production, fiber and granular insulation, geothermal systems etc [1-3].

Jurnal Teknologi

Full Paper

NUMERICAL SOLUTION OF UNSTEADY FREE CONVECTION FLOW IN A SECOND GRADE FLUID

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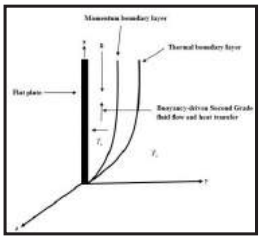

Abstract

In this paper, the problem of unsteady free convection flow moves along a vertical plate in a second grade fluid is studied. The vertical plate with constant temperature is considered. The dimensional governing equations are transformed into non dimensional equations using appropriate dimensionless variables and solved numerically using Finite Difference Method. Numerical results for velocity and temperature profiles are displayed graphically for viscoelastic parameter, Grashof number and Prandtl number and discussed in details. It is found that, increasing the values of Grashof number and time leads to increase in the velocity profiles. Increasing the values of the Prandtl number and viscoelastic parameter is found to decrease the velocity profile. It is further found that, increasing the values of Prandtl number tends to decrease the thermal boundary layer thickness.

Keywords: Unsteady; second grade fluid; free convection; heat transfer; finite difference method

Abstrak

Dalam kertas kerja ini, masalah aliran olakan bebas tak mantap bergerak disepanjang plat menegak di dalam bendalir gred dua dikaji. Plat menegak dengan suhu tetap dipertimbangkan. Persamaan menakluk yang bermatra diubah ke bentuk persamaan tak bermatra dengan menggunakan pembolehubah tak bermatra yang bersesuaian. Persamaan ini diselesaikan secara berangka dengan menggunakan Kaedah Beza Terhingga. Keputusan berangka bagi profil halaju dan suhu dipaparkan secara grafik untuk parameter viskoelastik, nombor Grashof dan nombor Prandtl dan dibincangkan secara terperinci. Keputusan menunjukkan, peningkatan nilai nombor Grashof dan masa menyebabkan profil halaju meningkat. Meningkatkan nilai nombor Prandtl dan parameter viskoelastik telah menurunkan profil halaju. Didapati juga, dengan nilai nombor Prandtl yang besar cenderung untuk mengurangkan ketebalan lapisan sempadan terma.

Kata kunci: Tak mantap; bendalir gred kedua; olakan bebas; pemindahan haba; kaedah perbezaan terhingga

1.0 INTRODUCTION

Recently, research in the boundary layer flow of non-Newtonian fluids have increased considerably due to the application in industrial and engineering particularly in the field of chemical engineering [1-3]. Viscoelastic fluids, which are known as one the sub-class of non-Newtonian fluids are the type of fluids which are more

Proactive Biometric-Enabled Forensic Imprinting

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ABSTRACT

Threats to enterprises have become widespread in the last decade. A major source of such threats originates from insiders who have legitimate access to the organization's internal systems and databases. Therefore, preventing or responding to such incidents has become a challenging task. Digital forensics has grown into a de-facto standard in the examination of electronic evidence; however, a key barrier is often being able to associate an individual to the stolen data. Stolen credentials and the Trojan defense are two commonly cited arguments used. This paper proposes a model that can more inextricably links the use of information (e.g. images, documents and emails) to the individual users who use and access them through the use of steganography and transparent biometrics. The initial experimental results of the proposed approach have shown that it is possible to correlate an individual's biometric feature vector with a digital object (images) and still successfully recover the sample even with significant file modification. In addition, a reconstruction of the feature vector from these unmodified images was possible by using those generated imprints with an accuracy of 100% in some scenarios.

Keywords: Digital forensics; biometrics; grille cipher, data leakage; guilty identification.

INTRODUCTION

Insider threats are considered to be a significant security issue (Collins, M. L., Spooner, D., Cappelli, D., Moore, A. P., & Trzeciak, 2013; Huth, 2013; Shabtai, Elovici, & Rokach, 2012). The recent decade has witnessed countless numbers of data loss and exposure incidents all over the world in which data has become publicly available and easily accessible (Verizon, 2015). The impact of losing or disclosing sensitive data or confidential intellectual property might cause

GB Patent filing GB1609673.7 dated 2nd June 2016

Vitamin D status in autism spectrum disorders and the efficacy of vitamin D supplementation in autistic children

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Objectives: Autism spectrum disorder (ASD) is a developmental disorder characterized by pervasive deficits in social interaction, impairment in verbal and non-verbal communication, and stereotyped patterns of interests and activities. Vitamin-D deficiency was previously reported in autistic children. However, the data on the relationship between vitamin D deficiency and the severity of autism are limited.
Methods: We performed a case–controlled cross-sectional analysis conducted on 122 ASD children, to assess their vitamin D status compared to controls and the relationship between vitamin D deficiency and the severity of autism. We also conducted an open trial of vitamin D supplementation in ASD children.
Results: Fifty-seven percent of the patients in the present study had vitamin D deficiency, and 30% had vitamin D insufficiency. The mean 25-OHD levels in patients with severe autism were significantly lower than those in patients with mild/moderate autism. Serum 25-OHD levels had significant negative correlations with Childhood Autism Rating Scale (CARS) scores. Of the ASD group, 106 patients with low-serum 25-OHD levels (<30 ng/ml) participated in the open label trial. They received vitamin D3 (300 IU/kg/day not to exceed 5000 IU/day) for 3 months. Eighty-three subjects completed 3 months of daily vitamin D treatment. Collectively, 80.72% (67/83) of subjects who received vitamin D3 treatment had significantly improved outcome, which was mainly in the sections of the CARS and aberrant behavior checklist subscales that measure behavior, stereotypy, eye contact, and attention span.
Conclusion: Vitamin D is inexpensive, readily available and safe. It may have beneficial effects in ASD subjects, especially when the final serum level is more than 40 ng/ml.
Trial registration number: UMIN-CTR Study Design: trial Number: R000016846.

Keywords: Autism, Neurodevelopmental, Children, Vitamin D

Introduction

Autism spectrum disorder (ASD) is a developmental disorder characterized by pervasive deficits in social interaction, impairment in verbal and non-verbal communication, and stereotyped patterns of interests and activities. The previous version of the manual (DSM-IV-TR) listed three distinct subgroups for ASD: autistic disorder, Asperger's syndrome, and pervasive developmental disorder not otherwise specified.[1] In 2013 were the separate diagnostic labels replaced by one umbrella term ASD in the new version of the manual (DSM-V).[2]

ASD has a complex and heterogeneous etiology, including both genetic and environmental factors. The interplay between genetic and environmental factors has become the subject of intensified research in the last several years.[3–6] Despite early evidence for heritability of ASD, the largest twin population-based studies have found that concordance rates for dizygotic twins were actually higher than previously reported and that shared prenatal environment

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Economic Production Quantity with Imperfect Quality, Imperfect Inspections, Sales Return, and Allowable Shortages

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Abstract - **This paper builds on the model of Yoo, Kim, and Park (S. H. Yoo, D.S. Kim, and M.-S. Park, "Economic production quantity model with imperfect-quality items, two-way imperfect inspection and sales return," International Journal of Production Economics, vol. 121 (1), pp. 255-65, 2009) and extend their model by considering the possibility that the producer can permit shortages which the producer can utilize to reduce the costs of inventory. The coverage of the model offers alternative and simplified modeling approach to the model. The concavity of the expected total profit function is proved under certain conditions. The concept is illustrated through a numerical example. It has been illustrated that the EPQ model with shortages is effective for certain ranges of the defective proportion and the probability of the Type 1 error; outside these ranges, the model with unpermitted shortages must be implemented.**

Keywords – EPQ, imperfect quality, imperfect inspection, shortage

I. INTRODUCTION

The Economic Order Quantity / Economic Production Quantity (EOQ/EPQ) models have long evolved from their basic assumptions to address important issues in inventory control, such as item's imperfect quality and quality assessment plans. In this direction, inventory models with the possibility of imperfect quality have been developed to determine the optimal lot size that either minimizes a cost function or maximizes a profit function. There have been recent advances in the literature on this topic. Ref. [1] assumes imperfect items in an inventory model where these imperfect items can be sold in a single batch at the end of a screening process, and it has been found that the economic lot size reacts positively to the increase in the average percentage of imperfect quality items. The inventory model in [2] allows for shortages to be backordered in a case where items can be of imperfect quality. In extending the model in [1], [3] allows for shortages which are backordered. Ref. [4] propose a profit maximizing inventory model to find the optimal lot size when the quality is imperfect, the inspection is influenced by two types of errors, and defective items are returned; the proposed model does not permit shortages. The model in [5] is an extension of an earlier model to include the possibility of increasing rate of inspection due to learning. Ref. [6] assign costs to Type 1 and Type 2 errors associated with the inspection. In a attempt to examine the key factors of the manufacturing process's instability and the defective item inventory, [7] develop EPQ models to determine the lot size and the backorder under the conditions of fixed vs. probabilistic fraction of defective items and the timing of defective items' withdrawal from inventory. Recently, [8] has determined the optimal lot sizes in the batch manufacturing setting with imperfect quality items when the producer implements acceptance sampling with destructive and non-destructive testing, implemented separately, to determine if the lot can be accepted or rejected. The EOQ model in [9] takes on the assumption of fixed screening rate, and the model considers the possibility of shortages occurring during the screening stage, and hence the screening rate is treated as a decision variable. The EOQ model developed in [10] considers misclassifications in inspection and shortages.

The paper extends the model of [4] by assuming the possibility of shortages which are backordered. This paper is organized as follows. Notations are introduced in the Section II. In Section III, the model is formulated and optimal solutions of the decision variables are obtained. In Section IV, a numerical example is presented along with the sensitivity analysis.

II. NOTATIONS

The notations in [4] will be maintained, with some notations being redefined, and new notations are introduced:

S_{max}	Maximum allowable shortage level
g	Shortage cost per item short
u	Shortage cost per item short per unit of time
T_M	Production time duration during the positive inventory
T_1	Beginning of cycle shortage time duration
T_2	Time duration of inventory depletion of serviceable items
T_3	Time duration of shortage buildup

III. MODEL FORMULATION

The objective is to find optimal quantity y^* and optimal shortage level $S^*_{\max}$ that maximize the total profit (total profit per unit time), which is the total revenues minus the total

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A Perspective on Collaboration with Interconnects & Routing in Network on Chip Architectures

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Abstract

As VLSI technology advances, the number of modules on a chip multiplies and thus the solutions for on-chip communication are evolving to support the new paradigm in inter-module communication on System on Chip (SOC). Those System on Chip, Current chip designs incorporate more complex multilayered and stack segmented interconnection buses with various routing architectures results in a Network on Chip. These, traditional solutions, which were based on a combination of shared-buses and dedicated module-to-module wires, scalability limit, and are no longer adequate for System on Chip/Network on Chip. On-chip architectures have been optimized for a non-chip environment before the multi-core challenge became the focus of processor chip architecture through the latency and the throughput. This evolution of on-chip interconnects may evoke feelings of among networking old-timers. The considerations that have driven data communication from shared buses to packet-switching networks and to routing protocols such as spatial reuse, multi-hop routing, flow and congestion control etc., will inevitably drive the challenges raised in the design of network interfaces with the segmented stack layered mechanism, and potentially managing the critical resources designed for on-chip modules.

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Keywords: Multicores; Network-on-Chip; Router; System-on-Chip; Xpipes.

1. Introduction

Currently, the chip design is to incorporate a full-fledged network-on-a-chip (NOC) consisting of a collection of links and routers and a new set of routing protocols that govern their operation. The survey reasons for the inevitable shift to NOCs in the VLSI world, while exposing the most important requirements from the NOC[1]. The aim is to expose the networking with system to the concept of network-on-chip (NOC) as a realm, within the VLSI in which the networking among the multi-cores plays a significant role in exploring the solutions such as network design, routing, and quality-of-service (QoS), unfamiliar settings under new constraints of VLSI. In order to stimulate some specific research directions, arising in each of these categories, focus is made on routing and resource allocations for the cores.

The first step was to address the low level challenges in designing on-chip interconnects in presence of deep sub-micron technologies. Due to the increased role of noise sources such as crosstalk, power-supply noise,

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ORIGINAL RESEARCH

Extenuating the role of *Ficus virens* Ait and its novel bioactive compound on antioxidant defense system and oxidative damage in cigarette smoke exposed rats

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Abstract— Introduction: Production of free radicals is associated with cigarette smoke (CS) which in turn generates oxidative stress, could be responsible for alterations in the activities of enzymatic and non-enzymatic antioxidants that links with atherosclerosis. **Methods:** Therefore, the putative preventive effects of *F. virens* extract and its bioactive compound (F18), n-Octadecanyl-O-α-D-glucopyranosyl(6'→1'')-O-α-D-glucopyranoside were investigated on overall enzyme and non-enzymatic defense system and in oxidative stress CS-exposed rats. **Results**: The enzymatic activities of hepatic and lung CAT, SOD, Gred and GST in CS exposed rats were significantly decreased, while Gpx activity in CS exposed rats was increased. Similarly, hepatic and lung GSH content was reduced when compared to value of normal control group. Simultaneous administration of FVBM extract (50 and 100 mg/rat) and F18 bioactive compound (1 mg/rat) significantly increases hepatic and lung CAT, SOD, Gred and GST activity as well GSH concentration coupled with decrease in Gpx level in CS-exposed stress rats. Moreover, our histological observations concludes the pulmonary congestion, thickening of interalveolar septa and foci of collapsed alveoli with subsequent dilation of the adjoining alveolar spaces as well as development of large irregular spaces in rats lung exposed to cigarette smoke. Similarly, the liver also showed morphological alterations with congestion in central vein, portal inflammation and necrosis in CS-exposed rats. These morphological changes reversed significantly after treatment with FVBM extract and F18 compound. **Conclusion**: Thus biochemical and histopathological studies suggested that, FVBM extract and F18 showed its protective nature against CS-exposed rats.

Keywords: Cigarette smoke, Oxidative stress, Antioxidant defense system, Histopathology, *Ficus virens*

INTRODUCTION

Oxidative stress is one of the major symptoms accompanying physiological functions and many pathological conditions such as cancer, diabetes, chronic obstructive pulmonary disease, cardiovascular and neurodegenerative diseases and also in the aging process itself (Aruoma, 1998; Santilli et al., 2015; Sen et al., 2010). Cigarette smoking (CS) contributes a considerable amount of free radicals, estimated as 10^{14} and 10^{15} free radicals/puff in the tar and gas phases (Church and Pryor, 1985) and is the major risk factor as well as leading cause cardiovascular disease (CVD) (Messner and Bernhard, 2014; WHO, 2015).

Moreover, CS generate free radicals that could be responsible for alterations in the activities of enzymatic viz., superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (Gpx), glutathione reductase (Gred), glutathione-s-transferase (GST) and non-enzymatic, namely GSH, antioxidants (Ramesh et al., 2007; Ramesh et al., 2015; Thirumalai et al., 2011).

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Prevalence and antimicrobial susceptibility pattern of staphylococci and streptococci causing ocular infections from a tertiary eye care hospital, South India.

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Abstract

Gram positive cocci viz., streptococci and staphylococci are found to be more predominant among ocular infections. Treatment of bacterial eye infections may engross empirical therapy with topical ophthalmic broad spectrum antibiotic formulations which is a prevailing practice among ophthalmologists. Ocular samples were collected from patients attending a tertiary eye care hospital, Coimbatore, south India from a total of 1802 ocular samples viz., Gram positive cocci (n=329), other bacteria & actinomycetes (n=561) and fungi (n=716), were isolated. Out of 329 Gram positive cocci, a total of 200 isolates viz., *Streptococcus pneumoniae* (n=76), coagulase negative staphylococci (CoNs) (n=49), *Staphylococcus aureus* (n=40), *S. viridans* (n=33) and *S. pyogenes* (n=2). The results revealed that the patients belonging to the age group between 60-80 years were most affected and male preponderance was observed. The isolates were subjected to antibiogram analysis with 15 different antibiotics according to the Clinical and Laboratory Standards Institute (CLSI) guidelines. Antibiotic viz., ampicillin, ofloxacin, gatifloxacin, levofloxacin, cefotaxime, cefazolin, piperacillin and vancomycin were found to effective against Gram positive cocci ocular infections.

Key words:

Eye, Infections, Staphylococcus, Streptococcus, Antibiotic susceptibility.

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Introduction

Eye is a unique and necessary organ that is constantly exposed to the external environment. Infection and inflammation of the ocular regions may lead to blindness if prompt and appropriate therapy is not instituted [1]. Suppurative keratitis or corneal ulcer can cause corneal opacity & perforation and is the second most common cause for monoocular blindness in developing countries after cataract. Depending on the geographical location, the aetiological factor may be fungus or bacterium [2].

Corneal ulcer involves the disruption of the epithelial layer with involvement of the corneal stroma [3]. Bacterial endophthalmitis can occur following the introduction of an infectious agent into the posterior segment of the eye, causing intraocular infection and inflammation that despite appropriate therapeutic intervention frequently results in visual loss. It occurs more frequently following cataract surgery, the most commonly performed type of intraocular surgery. Intraocular lens implantation and penetrating keratoplasty (corneal transplantation) are the common ocular surgical procedures with a greater potential for intraocular bacterial contamination

Planar Ultra-Wideband Elliptical Antenna for Communication Applications

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***Abstract*—**This paper introduces new design and implementation of low profile planner antenna for Ultra-Wideband (UWB) applications. This new antenna consists mainly of conducting elliptical patch and the partial conducting ground plane, with fabrication dimensions of 41.95x21.2x1.27 mm, the design was fabricated using Rogers 5880 LZ substrate. The impedance bandwidth of the designed antenna is between 3 GHz to 10.75 GHz and the selected ground length is 10 mm. VSWR and S_{11} are obtained for the new antenna through HFSS simulation for different ground plane lengths. Antenna group delay, maximum antenna gain and radiation pattern for this new antenna are studied and analyzed. We further take the design one step beyond the simulation and fabricate a prototype for testing. Simulation results and experimental results obtained from the fabrication show an excellent agreement, achieving the desired bandwidth.

Keywords— Antenna, Microstrip, UWB, S_{11}, HFSS, VSWR.

I. Introduction

MICROSTRIP antennas have widely been employed in various aspects and applications in electrical and communication engineering, where some parameters such as performance, size and cost present a challenge when it comes to the design process. These antennas have been shown to be the most efficient solutions serving various wireless communication and mobile radio applications. In addition, microstrip antennas can be easily implemented in both non-planar and planar surfaces [1]. With their introduction in R.E Manson in 1974 [2], microstrip antennas have been the focus and interest of many researchers [2]. Not only they are low in cost, but they are also easy to produce via printed-circuit technology [1].

Microstrip antennas are also known as patch antennas [3]. Generally, radiating elements and feed lines are photoetched on the dielectric substrate. The radiating patch can have different configurations and shapes, common examples of such shapes include rectangular, square, circular, dipole, triangle, and elliptical [1]. The increase interest in the microstrip antennas is due to simplicity in both fabrication and analysis in addition to their attractive radiation characteristics, particularly low cross-polarization radiation [4]. Microstrip dipoles are attractive due to the fact that they intrinsically have large bandwidth and require less space, resulting in making them attractive for antenna arrays [5]. Linear and circular polarizations can both be obtained with either single elements or arrays of microstrip antennas. Moreover, arrays of microstrip elements having either single or multiple feeds can also be employed to implement the scanning abilities and thus achieving better directivities [6].The principles of ultra-wideband (UWB) system has been related to some terms such as the impulse, baseband, carrier-free, non-sinusoidal, time domain, orthogonal function and large relative bandwidth radio and radar systems [7]. The main characteristic of a UWB system is the possession of an enormously wide bandwidth all thanks to employing impulse signals, compared to conventional radios. As of the late 60s, applications of UWB have been introduced and made practical exclusively for military purposes. These applications include transmitters, receivers, RF signals, antennas and systems [7]. To make these UWB systems available to the public while at the same time providing protection against potential interference and other electronic systems, the Federal Communications Commission (FCC) have issued the first report and order on 14th of February, 2002 [8].

In addition, these UWB systems are encouraged to have printed antenna. This simple and low profile antenna provides flexibility in integration with UWB radio, which not only lessens the assembly cost, but also provides robustness to the system. For this reason, much work has been done for the design of printed UWB antenna [9–13]. When it comes to the design *concept*, the rectangular patch is considered the most widely employed configuration as it is easy to be analyzed by both the transmission line and the cavity models [14]. However, the circular patch or disk is known to be the most well-known configuration. It attracted the attention of many scientists and researchers as a single element (e.g. [15], [16], [17], and [18]), as well as arrays [19]. Moreover, a thorough study of a novel monopole antenna for UWB embedded applications on a dielectric substrate which being fed by a 50 Ω microstrip line was introduced in [20], whereas, an elliptical ring antenna fed by a coplanar waveguide line for UWB applications was given in [21]. The performance and the design of an UWB printed monopole with axis symmetrical elliptical slots for tunable band-notched characteristics was presented in [22] and an ultra wideband planar elliptical dipole antenna for EMC measurements was studied [22]. Two elliptical elements of the dipole antenna are printed on a circular dielectric substrate and fed by a coaxial cable was presented in [23].

In general microstrip patch antenna design involves several parameters such as patch shape and size, substrate dielectric constant and thickness, feed type and location, and size of ground plane. This paper presents the design of elliptical patch antenna with defined dimensions. The design of this antenna depends on forth mentioned parameters [24-29]. The elliptical shape provides flexibility of the design as well as changing the

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Type 2 diabetes mellitus: Link between diet, HbA1c and complications

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REVIEW

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ABSTRACT

Background
Diabetes mellitus is now globally considered as a leading cause of morbidity and mortality. It is associated with high rates of microvascular and macrovascular complications. Regular consumption of high caloric food, poor dietary habits and adoption of sedentary life style has been linked with the development of type 2 diabetes mellitus.

Aims
The purpose of this review is; to highlight the influence of diet on HbA1c in type 2 diabetics, to explore association between HbA1c and diabetes complications and to propose a dietary consultation model for more effective diabetes care.

Methods
The literature was reviewed intensively from January – March 2016 through PubMed central, Medscape, Google Scholar and other databases. The keywords and MeSH terms used in this search were “diabetes mellitus”, “glycated haemoglobin”, “type 2 diabetes mellitus”, “diet and type 2 diabetes mellitus” and “diabetes complications”.

Results
Dietary management is a superior option for glycaemic control in type 2 diabetes mellitus. It is important to keep the HbA1c level in acceptable range to delay the onset and progression of diabetes complications. In this review, various food groups that can have beneficial and adverse effects on HbA1c have been identified. Moreover, Diabetic Retinopathy (DR) stood out as the most prevalent complication of poorly managed diabetes mellitus in Saudi Arabia.

Conclusion
The dimensions of the proposed dietary consultation model are based on the assessment of diabetics’ diabetes mellitus knowledge, dietary knowledge, dietary attitude and dietary practices. This assessment if carried out at the initial stage of Diabetes mellitus can be helpful in delaying the early onset and progression of microvascular and macrovascular diabetes complications.

Key Words
Glycaemic control, diabetes complications, diet, type 2 diabetes mellitus

What this review adds:

Dietary management is considered as a corner stone in the management of type 2 diabetes mellitus. Therefore, in this review, link between diet, HbA1c and diabetic complications have been presented. The review concludes by proposing a dietary consultation model for more effective diabetes care. The consultation model if used at an initial stage of Diabetes mellitus can be useful in delaying the early onset and progression of diabetes complications

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Framing the features of Brownian motion and thermophoresis on radiative nanofluid flow past a rotating stretching sheet with magnetohydrodynamics

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ABSTRACT

This article addresses the combined effects of chemical reaction and viscous dissipation on MHD radiative heat and mass transfer of nanofluid flow over a rotating stretching surface. The model used for the nanofluid incorporates the effects of the Brownian motion and thermophoresis in the presence of heat source. Similarity transformation variables have been used to model the governing equations of momentum, energy, and nanoparticles concentration. Runge-Kutta-Fehlberg method with shooting technique is applied to solve the resulting coupled ordinary differential equations. Physical features for all pertinent parameters on the dimensionless velocity, temperature, skin friction coefficient, and heat and mass transfer rates are analyzed graphically. The numerical comparison has also presented for skin friction coefficient and local Nusselt number as a special case for our study. It is noted that fluid velocity enhances when rotational parameter is increased. Surface heat transfer rate enhances for larger values of Prandtl number and heat source parameter while mass transfer rate increases for larger values of chemical reaction parameter.

Introduction

The study of boundary layer flow and heat transfer over a stretching sheet has many important industrial and technological applications such as materials manufactured by polymer extrusion, drawing of copper wires, continuous stretching of plastic films, artificial fibres, hot rolling, wire drawing, etc. In these cases, the final product of desired characteristics depends on the rate of cooling in the process and the process of stretching. Crane [1] investigated the steady two-dimensional boundary layer flow caused by the stretching of the sheet which moves in its own plane at a velocity that varies linearly with the distance from the slit. Later many researchers extended this problem to the Newtonian and non-Newtonian fluids under various physical conditions. Gupta and Gupta [2] studied the heat and mass transfer characteristics with suction or blowing. Rajagopal et al. [3] analysed the characteristics of the boundary layer flow for small values of viscoelastic parameter and showed that the skin friction coefficient decreases with the increase of viscoelastic parameter. Char [4] discussed the effects of magnetic field and power law surface temperature on heat and mass transfer from a continuous flat surface.

The problems of heat and mass transfer in combination with radiation are of great importance in manufacturing industries for the design of fins, steel rolling, nuclear power plants, and gas turbines and various propulsion devices for aircraft, missiles, satellites and space vehicles, etc. The radiative flow of an electrically conducting fluid with high temperature in the presence of magnetic field occurs in electrical power generations, astrophysical flows, solar power technology, etc. Raptis [5] studied the role of radiation in a viscoelastic fluid flow. Abd El-Aziz [6] analyzed the effect of radiation on the unsteady flow and heat transfer over stretching surface. Thermal radiation effects on heat and mass transfer over a stretching sheet was investigated by Shateyi and Motsa [7].

Changes in fluid density gradients may be caused by nonreversible chemical reaction in the system as well as by the differences in the molecular weight between values of the reactants and the products. Apelblat [8] studied analytical solution for mass transfer with chemical reaction of the first order. Chemical reaction effects on MHD heat and mass transfer flow over a stretching surface in a porous medium was studied by Cortell [9]. Anjalidevi et al.

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Persistent architecture for optimizing web service for e-government implementation

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***Abstract*— Information in government sector is increasing day by day. The government is providing its citizens e-services which are getting cluttered and difficult to use and consume by the citizens of the country. Information redundancy is becoming a critical topic for all the governmental transactions and thus overloading the databases and the information pool. In this research we focus on creating an architecture for optimizing the information flow within the governmental database schemas which will pull and push information as and when required by the services. We will be designing web services which will act as tuners and transmitters that pull and push data from the data warehouse and transmit the required data to the requesting web services. Thus reducing the amount of information redundancy in the warehouse. We will be creating optimization web services which will inform us about information redundancy in the e-government services. Thus by doing so we improve the throughput and efficiency of the e-government system.**

Keywords—Service Oriented Architecture; Web Service; E-Governance; Optimization ; Datawarehousing; Service Providers and Service Consumers

I. Introduction

As internet is flooded with information its important to keep track of relevant information which is useful to the government and its stake holders. E- government is driven by various other aspects surrounding the information technology which as economics, cultural and technological. As most of the countries and their governments to around the globe are striving to provide electronic services to the stake holders its becoming difficult to manage huge information for least cost. As the services provided by the government to the stake holders are creating transparency between the citizen and the governmental procedures and policies they are also creating chaos and misleading information dissemination the stake holders at large. Riley in his definition of E-Governance state that it provides better relation among government and its people, providing much more opportunity for expression [1].

E-government has been introducing lots of services to its stake holder some of which include e-democracy, e-voting, e-justice, e-education, e-healthcare, e-reservations, e-market and many more. But as the number of services are increasing the data warehouse for managing these services is also increasing and the complexity of the data bases are also increasing. Thus as information is plaguing the governmental services its important to manage and maintain some kind of information redundancy services which can cater to information mapping with other services as and when they request for the required information from the data warehouse. Information security is a key concern and it needs to be addressed as the data warehouse hold huge amount of e-government data to address this issues prioritization can be used as a tool for better management of these risks using Analytic Hirarchy Process (AHP) [2]. The e-government system needs to be more agile and all the services which cater to most of the developments need to talk to each other using SOAP (Simple Object Access) protocol. As most of the stakeholder's issues are solved using the e-services provided by the government information security becomes a critical factor for the government in this insecure world if information is growing many folds its important to have information redundancy so that all the information is centralized and secured from the hackers and the attackers. Citizens data is crucial to the country today as many e-services are requesting data from different data warehouses its difficult to keep track for various transactions being performed by the citizens of the country which lead to frauds and security birches which can affect the economical strength of the banking sectors and others too. As information grows infrastructure becomes a problem we need to have bigger space to house many servers which in turn needs cooling system like air conditioned rooms which leads to global worming problem and much more. All these problems arise because of information duplication and mismanagement of the inter process communication between web services which are employed in the e-government sectors. Cloud computing has also taken a big leap in e-governance but the security issues still remain not only with the e-government service but also the cloud computing security issues. Duplicate Information is flooded across the government sectors as they do not share information as and when required by the other departments of the government.

II. System Configuration and Management

As e-government revolves across giving better and more services to the stakeholders our focus in this research is to centralize he data storage and connect and redesign the web services for inter-process communication so that information duplication can be reduced and the efficiency of the e-

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Classifying and Predicting Instances for Smoking Cessation Management System (Smoke Mind)

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***Abstract* – Smoking is one of the major activities that can become highly addictive and can cause major health-related risks. It is one of the major causes of death worldwide. There are various issues revolving around smoking and its complications. To assess the impact of smoking, its complications, and the process of achieving smoking cessation, an online survey was conducted. In this study, the results of the survey are used as a dataset to which various data mining classification techniques are applied. The study has found that the Naïve Bayes algorithm gives the best performance on the survey data with an accuracy of 84.713 and an execution time of 0.11 seconds, followed by J48 and Logistic Regression.**

***Keywords* – data mining, smoking cessation, classification, decision table, Naïve Bayes technique.**

I. Introduction

Smoking is one of the most serious health challenges being faced globally. The effects of smoking are very harmful as it is highly addictive and has both long-term and short-term effects on the body. Nicotine addictions, risk of using other drugs, respiratory and non-respiratory effects are a few short-term health complications that can arise from smoking. Continuing to smoke in adulthood, and reduced lung growth and function are some of the long-term effects among the young population. Heart disease, stroke, lung cancer, reduced heart rate, and shortness of breath are other major complications that can arise from smoking [1]. The seriousness of smoking and its effects can be understood from the fact that it causes more than 6 million deaths, 600,000 of which are exposed to second-hand smoke [2]. Considering the seriousness of the issue, it is very important to implement an effective surveillance system through different modes of data collection. The GTSS (Global Tobacco Surveillance System) is one such initiative taken by the WHO and its partner organisations, with the objective of formulating protocols and guidelines for data collection. It covers a wide range of functions including a questionnaire and sample design, fieldwork implementation, data management, data analysis and reporting, and data release and dissemination [3]. The purpose of GTSS is also to enhance the efforts of countries in data collection and management as a part of a tobacco surveillance system [4].

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The process of data collection and analysis is an important function in this process, where the data collected has to effectively analysed, in order to obtain a meaningful output or an understandable dataset, which can be used for further analysis or research. This process is also known as data mining.

Data mining allows the users to analyse the data from different perspectives and summarise the data into useful information, which in turn is used to gather explicit knowledge. This can be used in various scenarios such as cost-cutting, effective utilisation of resources, increasing revenue etc. Usually, information systems/software applications with different analytical tools are used in this process [5]. Data mining is becoming increasingly popular in many industries, as it helps to make effective decisions with an effective analysis of data. Similarly, data mining has great potential in the healthcare industry as it could benefit all of the stakeholders involved. It can help healthcare providers to effectively track the spread of any disease and can help with formulating mitigation plans. It can also help insurance companies with detecting fraud and abuse cases; it can help healthcare providers with developing effective strategies in healthcare delivery by increasing the process efficiency and reducing costs. It can ensure good customer relationship management practices as the service delivery can be improved at affordable costs. Usually, healthcare transactions are voluminous and complex, and often involve large amounts of data, which cannot be easily analysed with traditional methods. Data mining can provide the methodology, technology and analytical tools for analysing such large complex data, to generate useful information and explicit knowledge that can be used for effective decision making [6, 7].

Smoking and achieving smoking cessation can be explained as a multi-dimensional behaviour influenced by various factors, which could be physiologic, biologic, psychological, social, and related to the community; these can be defined in a classification model. Despite various initiatives, policies and regulations, and advanced research studies in the field, smoking is still a major concern with regard to public health [8]. Considering this multi-dimensional behaviour, data mining could be an effective method for analysing patterns in order to derive an effective output that can be used for better decision making in smoking cessation. Data mining could help

Data mining technique for the Enhanced Smoking Cessation management system (Smoke Mind)

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Abstract

Data mining can be defined as the use of complex tools of data analysis to discover previously unknown relationships and patterns in large datasets. The tools may include mathematical algorithms, statistical models and machine learning methods. Therefore, data mining comprises techniques that enable more processes than data collection and management, including data analysis and prediction. Healthcare databases have huge amounts of data, and with effective analysis tools, a great deal of hidden knowledge may be discovered. Therefore, data mining can be particularly useful for analysing and extracting hidden knowledge in huge amounts of data such as those obtained from smokers. Data mining has found an application in the healthcare system. Data mining in healthcare organisations can transform the raw data held by the organisation into useful knowledge with minimal intervention by the user, be it a doctor or an administrator. It also can help to discover new healthcare knowledge for clinical and administrative decision making, as well as producing scientific hypotheses from large sets of experimental data and clinical databases. In the analysis of smoking behaviour, there are a limited number of cases where data mining has been well utilised. A review of the literature on the subject reveals that there is an apparent lack of theoretical and empirical frameworks that address how data mining can be used to better understand smokers and smoking patterns in order to improve the design and content of smoking cessation programmes. This study aims to build a self-developing system for improving smoking cessation programmes using a data mining technique to detect smoker behaviour, and behaviour change therapy to determine the smokers quit plan. The system is based on a continuous acquisition of data, thereby improving its results regularly.

Keywords – data mining, smoking cessation, classification, decision table, Naïve Bayes technique.

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FLOW OF AN ERYING-POWELL FLUID OVER A STRETCHING SHEET IN PRESENCE OF CHEMICAL REACTION

by

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In this paper we study the flow of an incompressible Erying-Powell fluid bounded by a linear stretching surface. The mass transfer analysis in the presence of destructive/generative chemical reactions is also analyzed. A similarity transformation is used to transform the governing partial differential equations into ordinary differential equations. Computations for dimensionless velocity and concentration fields are performed by an efficient approach namely the homotopy analysis method and numerical solution is obtained by shooting technique along with Runge-Kutta-Fehlberg integration scheme. Graphical results are prepared to illustrate the details of flow and mass transfer characteristics and their dependence upon the physical parameters. The values for gradient of mass transfer are also evaluated and analyzed. A comparison of the present solutions with published results in the literature is performed and the results are found to be in excellent agreement.

Key words: *mass transfer, destructive/generative chemical reactions, Erying-Powell fluid, analytical solution, numerical solution*

Introduction

The flows of non-Newtonian fluids have been of great importance and increasing interest for the last few decades. Perhaps, it is due to their several engineering and technological applications. Few examples of the non-Newtonian fluids are coal water, jellies, toothpaste, ketchup, food products, inks, glues, soaps, blood, and polymer solutions. It is well known that there is no unique relationship available in the literature like Newtonian law of viscosity for viscous fluids that can describe the rheology of all the non-Newtonian fluids. It is due the diversity of non-Newtonian fluids in nature in terms of their viscous and elastic properties. Mathematical systems for non-Newtonian fluids are of higher order and complicated in comparison to the Newtonian fluids. Despite of all these difficulties and complexities, several researchers in the field are involved in making valuable contributions to the studies of non-Newtonian fluid dynamics [1-10]. The non-Newtonian fluid models vary in their complexity and ability to capture different physical phenomena. Of course, no single model can capture all the features of the non-Newtonian fluids complexities and hence different models are used to represent different characteristics of the non-Newtonian fluids. Among these fluid models the Powell-Erying flu-

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SLIP EFFECTS ON UNSTEADY FREE CONVECTIVE HEAT AND MASS TRANSFER FLOW WITH NEWTONIAN HEATING

by

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This article investigates the effects of slip condition on free convection flow of viscous incompressible fluid past an oscillating vertical plate with Newtonian heating and constant mass diffusion. The governing equations together with imposed initial and boundary conditions are solved using the Laplace transform technique. The results for velocity, temperature, and concentration are obtained and plotted for the embedded parameters. The results for skin friction, Nusselt number, and Sherwood number are computed in table. It is investigated that the presence of slip parameter reduces the fluid velocity.

Key words: *slip effects, oscillating plate, Newtonian heating, heat transfer, mass transfer, Laplace transform*

Introduction

The free convection flows together with heat and mass transfer are of great importance in geophysics, aeronautics, and engineering. In several process such as drying, evaporation of water at body surface, energy transfer in a wet cooling tower, and flow in a desert cooler, heat and mass transfer occurs simultaneously. Soundalgekar *et al.* [1, 2] for instance, have studied the mass transfer effects on the flow past an oscillating vertical plate with constant heat flux and variable temperature, respectively. Asogwa *et al.* [3] investigated heat and mass transfer past a vertical plate with periodic suction, and heat sink using perturbation technique. In addition, the interest of researchers to study the interaction of convection phenomenon with thermal radiation has been increased greatly during the last few decades due to its importance in many practical involvements. The advancement of space technology and in processes involving high thermal radiation effects play an important role. Recent developments in industrial technology have focused attention on thermal radiation as a mode of energy transfer, and emphasize the need for improved understanding of radiative transfer in these processes [4-6]. Radiation effects on free convection flow over a vertical plate with mass transfer were presented by Chamkha *et al.* [7]. Chandrakala and Bhaskar [8] also considered the radiation effects with uniform heat flux and mass diffusion. Recently, Abid *et al.* [9] stud-

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Prevalence and risk factors of diabetic retinopathy in Saudi Diabetics in Majmaah City

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RESEARCH

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ABSTRACT

Background
Diabetes mellitus (DM) is one of the most common chronic diseases worldwide. Diabetic retinopathy (DR) is the most common complication of DM and it is the leading cause of blindness in the Kingdom of Saudi Arabia.

Aims
The study was conducted to determine the prevalence and risk factors of DR in patients with type II DM in Al Majmaah City, Saudi Arabia.

Methods
We conducted this cross-sectional study from February 2014 until May 2015. Out of the 1546 diabetic patients registered in the primary care centres of Majmaah city, a random sample of 327 patients were selected. An expert ophthalmologist took a detailed history and performed ophthalmic examination on all patients. Mean ± S.D was measured for quantitative variables. Frequencies and percentages were given for qualitative variables. Logistic regression was applied to associate DR with alleged risk factors.

Results
The prevalence of DR among the study group was 35.8 per cent. Non-proliferative diabetic retinopathy was prevalent in 31.8 per cent cases. We tested the association between DR and various risk factors. We found that patients, who develop DM when they were between 40 and 60 years, have more chance to develop DR.

Conclusion
DR is affecting more than one third of diabetic patients in Saudi Arabia. There is an urgent need to establish and promote national screening and management programs for DR. Delaying the onset of DM after the age of 60 may help to lessen that problem.

Key Words
Diabetic retinopathy, diabetes mellitus, prevalence, Majmaah, Saudi Arabia

What this study adds:

1. What is known about this subject?
The prevalence of DR among diabetics varies from country to country and from region to region in the same country. Many known risk factors of DR are already well studied.

2. What new information is offered in this study?
Prevalence of DR among diabetics in Majmaah city has been reported for the first time. The age of onset of DM is an important risk factor that has been identified in this study.

3. What are the implications for research, policy, or practice?
Screening and management programs of DR are needed urgently in KSA. Delaying the onset of DM may help to slow down the progression towards DR.

Background

Diabetes mellitus (DM) is one of the most common chronic diseases all over the world, and continues to increase in numbers and significance.[1] Saudi Arabia ranked third among

Heat Transfer on Mixed Convection Flow of Rotating Second Grade Fluid with Ramped Wall Temperature

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Abstract. This article discussed the effect of ramped wall temperature on rotating second grade fluid in mixed convection flow. The unsteady two dimensional momentum and energy equations of the incompressible fluid are modelled in the form of partial differential equations with initial and oscillating boundary conditions. The governing equations are transformed into non dimensional equations by using the corresponding non dimensional variables. The Laplace transform method is applied into non dimensional equations in order to obtain the analytical solutions of velocity and temperature profiles. Computations are carried out and presented graphically to analyse the effect of second grade fluid parameter, rotation parameter, Grashof number, phase angle, Prandtl number and time on the profiles. It is found that, when Grashof number increases, the velocity increases in primary and secondary velocities. Both velocity and temperature are observed decrease when phase angle and Prandtl number increase. It can be concluded that, the velocity profiles in rotating flow obtained in this study is lower to compare with non-rotating flow. Whereas, the temperature profiles are remain the same for both cases. It is worth to mention that, the exact solutions obtained in this study can be used to check the correctness of the results obtained through numerical schemes.

INTRODUCTION

The study of ramped wall temperature in heat transfer flow has received much attention in recent years both analytically and experimentally. This study is useful to investigate the behavior of fluid under step change in wall temperature. Their applications can be found in nuclear heat transfer control, materials processing, building heat transfer, turbine blade heat transfer and electronic circuits [1-4]. Having such motivation, Samiulhaq *et al*. [5] investigated the effect of ramped wall temperature in free convection flow of viscous fluid through wall slip condition. The exact solutions of this study were obtained by using Laplace transform method. Arshad *et al*. [6] discussed the exact solutions of magnetohydrodynamics (MHD) flow in a porous medium with ramped wall temperature. They were also considered the wall slip condition of boundary condition. Next, they solved two similar problems but concentrated on ramped wall temperature with inclined plate [7] and ramped wall temperature with time independent shear stress [8]. Research on ramped wall temperature has reported excellent results for different non-Newtonian fluids flow such as Brinkman Type fluid [9] and second grade fluid [10]. After that, Samiulhaq *et al*. [11] and Mohamad *et al*. [12] extended the problem of [10] by considering the effects of MHD flow in a porous medium and rotating fluid flow. All these researches were solved analytically by using technique of Laplace transform. From this discussion, most of researchers have done the problem of ramped wall temperature with free convection flow phenomena. In contrast, forced convection flow occurs when the flow is caused by external force. Besides that, the combination of these convections (free and forced convections) will be producing

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Molybdenum Disulfide Nanoparticles Suspended in Water-Based Nanofluids with Mixed Convection and Flow inside a Channel filled with Saturated Porous Medium

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Abstract. The shape effect of molybdenum disulfide nanoparticles suspended in water-based nanofluids with mixed convection flow inside a channel filled with saturated porous medium is studied. The radiation effect is also considered. One of the boundary walls of the channel is oscillating in its own plane. Four different shapes (platelet, blade, cylinder, and brick) of molybdenum disulfide nanoparticles inside a water, chosen as a conventional base fluid are used. The partial differential equations governed the problem are solved analytically by using perturbation method. Solutions for velocity and temperature are obtained and discussed graphically. A comparison of different shapes of molybdenum disulfide nanoparticles is analyzed. Results show that, nanoparticles with platelet and cylinder shapes have the highest thermal conductivity and viscosity compared to blade and brick shapes.

INTRODUCTION

Molybdenum disulfide, MoS_2 has attracted the interest of researchers due to its promising applications in many areas especially, in two dimensional electronic devices such as field effect transistors (FETs). Similar to graphene, molybdenum disulfide has single and multilayer sheets with large band gap structure. Due to this special structure, it has been extensively applied for logic circuits and amplifier devices [1-6]. Further, thermo-physical properties of molybdenum disulfide nanofluids such as thermal conductivity and heat capacity as well as lubrication abilities also can be used in mechanical applications [7-8]. Gu *et al.* [9] showed that, MoS_2 nanofluids can protect the substrate from scratching and wear due to its self-healing property. Kato *et al.* [10] then studied wear and mechanical properties of sintered copper–tin composites containing graphite or MoS_2. Solvent-free ionic MoS_2 nanofluids was also analyzed by Zhang *et al.* [11]. They reported that, MoS_2 nanofluids showed Newtonian behavior. The tribological properties of nanofluids used in minimum quantity lubrication grinding were investigated by Mao *et al.* [12]. They noted that, minimum quantity lubrication (MQL) grinding using nanofluids showed superior grinding performance. They also reported that, during mechanical work, large amount of heat is produced particularly in grinding zone, thus it reduce the efficiency of machinery and surface quality of work piece. Therefore, MoS_2 nanofluids can be used to cool the surface and lubricant [13]. An experimental investigation on thermal properties of MoS_2 nanofluids has been discussed by Su *et al.* [7]. The effect of nanoparticles concentration on the lubricating property of nanofluids for MQL grinding of Ni-based alloy was investigated by Zhang *et al.* [14]. The heat capacity, thermal conductivity, and volumetric thermal expansion coefficients were experimentally studied by [15-18].

The quality of nanofluids not only depends on the type of nanoparticles but also their shapes. Researchers usually use nanoparticles of spherical shapes. However, in terms of applications and significance, spherical shaped

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RESEARCH ARTICLE

BAD, a Proapoptotic Protein, Escapes ERK/RSK Phosphorylation in Deguelin and siRNA-Treated HeLa Cells

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Abstract

This study has been undertaken to explore the therapeutic effects of deguelin and specific siRNAs in HeLa cells. The data provided clearly show the silencing of ERK 1/2 with siRNAs and inhibition of ERK1/2 with deguelin treatment in HeLa cells. Additionally, we are providing information that deguelin binds directly to anti-apoptotic Bcl-2, Bcl-xl and Mcl-1 in the hydrophobic grooves, thereby releasing BAD and BAX from dimerization with these proteins. This results in increased apoptotic activity through the intrinsic pathway involved in rupture of mitochondrial membrane and release of cytochrome C. Evidence for inhibition of ERK1/2 by deguelin and escape of BAD phosphorylation at serine 112 through ERK/RSK pathway has been further fortified by obtaining similar results by silencing ERK 1/2 each with specific siRNAs. Increase in BAD after treatment with deguelin or siRNAs has been interpreted to mean that deguelin acts through several alternative pathways and therefore can be used as effective therapeutic agent.

Introduction

A number of natural compounds have been shown to have apoptotic activity against a variety of cancers [1]. The chemotherapeutic activity of deguelin, a retinoid, extracted from *Mundulea Sericea* (Leguminosae) is presently under intensive investigation [2–4]. Strong antitumor activity of deguelin has been demonstrated both in vitro and in vivo [2,5]. Substantial evidence is now available to show that deguelin inhibits PI3K-Akt pathway. The inhibitory effect of deguelin on RAS-MAPK pathway has also been demonstrated In one report data have been provided in which deguelin has been shown to suppress Iκk, Iκb and NFκB, thereby reducing the

Heat and Mass Transfer of Unsteady MHD Free Convection Flow of Second Grade Fluid with Newtonian Heating

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Abstract. The effect of Newtonian heating on unsteady magnetohydrodynamic (MHD) free convection flow of second grade fluid over an oscillating vertical plate with radiative heat transfer is studied. The partial differential equation is modelled with some physical conditions. An appropriate dimensionless variables are employed to the governing equations and their solutions are obtained in a closed form using Laplace transform technique. Graphical results of involved parameters for velocity, temperature and concentration profiles are displayed and discussed. The important finding in this study are the Newtonian heating acts as boosting agent in velocity and temperature distribution whereas the magnetic field tends to retards the fluid flow.

INTRODUCTION

The analysis of heat transfer is become quite prominent nowadays since it was found frequently in nature and as well as in many aspects of engineering applications. For examples heated and cooled enclosures, heat transfer from nuclear fuel rods to the surrounding coolant, dissipation of heat from the coil of a refrigerator unit to the surrounding air and heat transfer from a heater to room air. The problems due to heat transfer have been extended to different flow situations where the thermal boundary conditions play a very vital role. Merkin [1] mentioned that, in general there are four types of heating processes specifying the wall to ambient temperature distributions namely constant or prescribed wall temperature, constant or prescribed surface heat flux, conjugate boundary conditions and Newtonian heating. In this problem, Newtonian heating in which heat transfer from the bounding surface with a finite heat capacity is proportional to the local surface temperature and usually termed as conjugate convective flow is given attention. Such boundary condition is also called as Robin boundary condition [2]. Merkin [1] seem to be the first researcher studied the problem of natural convection boundary layer flow on a vertical surface generated by Newtonian heating.

On the other hand, heat transfer problem with thermal radiation for boundary layer flow past a moving vertical plate concerning with a convective boundary condition was extensively studied by Narahari and Ishak [3]. Later, Das et al. [4] considered a similar problem [3] past over a vertical plate and solved numerically using finite difference technique. Narahari and Nayan [5] investigated the effect of mass diffusion on unsteady free convection flow past an impulsively started infinite vertical plate with Newtonian heating in the presence of radiation and the governing equations are solved using Laplace transform method. An exact solution of unsteady natural convection flow of viscous fluid past an oscillating plate with Newtonian heating was presented by Hussanan et al. [6]. Hussanan et al. [7] extended [6] to study the mass transfer effect. Moreover, Hussanan et al. [8] obtained an exact analysis to study the unsteady boundary layer MHD free convection flow past an oscillating vertical plate embedded in a porous medium with constant mass diffusion and Newtonian heating. Furthermore, Jain and Chaudhary [9]

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E3 and M2 transition strengths in $^{209}_{83}$Bi

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(Dated: October 22, 2015)

The $1i_{\frac{13}{2}} \rightarrow 1h_{\frac{9}{2}}$ ($M2$) and $3s_{\frac{1}{2}} \rightarrow 2f_{\frac{7}{2}}$ ($E3$) reduced proton transition probabilities in $^{209}_{83}$Bi have been determined from the direct half-life measurements of the $\frac{13}{2}^+_1$ and $\frac{1}{2}^+_1$ states using the ROmanian array for γ-ray SPectroscopy in HEavy ion REactions (*ROSPHERE*). The $\frac{13}{2}^+_1$ and $\frac{1}{2}^+_1$ states were found to have $T_{\frac{1}{2}}$=0.120(15) ns and $T_{\frac{1}{2}}$=9.02(24) ns respectively. Angular distribution measurements were used to determine an $E3/M2$ mixing ratio of δ=-0.18(2) for the 1609 keV γ-ray transition de-exciting the $\frac{13}{2}^+_1$ state. This value for δ was combined with the measured half-life to give reduced transition probabilities of B($E3, \frac{13}{2}^+_1 \rightarrow \frac{9}{2}^-_1$)=13(2)$\times 10^3$ e^{2}fm^6 and B($M2, \frac{13}{2}^+_1 \rightarrow \frac{9}{2}^-_1$)=0.038(5)$\times 10^3$ μ_N^2 fm^2. These values are in good agreement with calculations within the finite Fermi system. **The extracted value of B($E3, \frac{1}{2}^+_1 \rightarrow \frac{7}{2}^-_1$)=6.3(2)$\times 10^3$ e^{2}fm^6 can be explained by a small ($\sim$6%) admixture in the wavefunction of the $\frac{1}{2}^+_1$ state.**

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I. INTRODUCTION

The ground state of $^{209}_{83}$Bi can be described as a single $1h_{\frac{9}{2}}$ proton coupled to the $^{208}_{82}$Pb core [1]. **A septuplet of levels with spins between $\frac{3}{2}$ and $\frac{15}{2}$, formed due to the coupling of the same proton to the 3$^-$ octupole vibrational state in of the $^{208}_{82}$Pb core, is observed at an excitation energy of $\sim$2.6 MeV. The three states below this septuplet are predominately formed from the excitation of the single proton [1].** Present information on the properties of low-lying states in $^{209}_{83}$Bi was determined from **comprehensive inelastic scattering [2–6]**, Coulomb excitation [7–11], direct decay time [12–14] and multi-nucleon transfer reaction [1, 15] measurements.

In cases where the properties of low-lying excitations in single-nucleon systems are simple to interpret and can be described using basic theoretical models, effective multipole operators have been shown to describe static electric and magnetic multipole moments and low-energy-transition rates [16]. Re-normalisation effects are incorporated in the effective multipole operators, which in the case of electric multipoles, mainly arise from the core polarisation mechanism [17]. Because the uncertainties for configuration mixing in the lead region are smaller than in other regions around closed-shell nuclei (e.g. ^{16}O,^{40}Ca), Mottelson has advocated that the lead region is possibly the best place to explore the effective charge phenomena [18]. Therefore, this article presents new measurements on low-lying levels in $^{209}_{83}$Bi from which the strength of the single-particle $1i_{\frac{13}{2}} \rightarrow 1h_{\frac{9}{2}}$ and $3s_{\frac{1}{2}} \rightarrow 2f_{\frac{7}{2}}$ transitions have been extracted.

The strength of the $1i_{\frac{13}{2}} \rightarrow 1h_{\frac{9}{2}}$ $M2$ transition can be obtained from the half-life of the $\frac{13}{2}^+_1$ level and the $E3/M2$ mixing ratio of the depopulating transition. The latter is required because the $\frac{13}{2}^+_1$ state (E$_x$=1609 keV) is known to be a mixture of a single proton in the $1i_{\frac{13}{2}}$ shell coupled to the 0$^+$ ground state in the $^{208}_{82}$Pb core, and a single proton in the $1h_{\frac{9}{2}}$ shell coupled to the 3$^-$ octupole vibrational state in $^{208}_{82}$Pb [7, 19, 20], as shown schematically in Fig. 1.

The B($E3$) excitation probability to the $\frac{13}{2}^+_1$ level has been measured in Coulomb excitation experiments using α and ^{16}O beams to be 12.4(32)$\times 10^3$ e^{2}fm^6 [7] and 22(8)$\times 10^3$ e^{2}fm^6 [8]

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Regular Article

Heat and mass transfer in nanofluid thin film over an unsteady stretching sheet using Buongiorno's model

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Abstract. The heat and mass transport of a nanofluid thin film over an unsteady stretching sheet has been investigated. This is the first paper on nanofluid thin film flow caused by unsteady stretching sheet using Buongiorno's model. The model used for the nanofluid film incorporates the effects of Brownian motion and thermophoresis. The self-similar non-linear ordinary differential equations are solved using Maple's built-in BVP solver. The results for pure fluid are found to be in good agreement with the literature. Present analysis shows that free surface temperature and nanoparticle volume fraction increase with both unsteadiness and magnetic parameters. The results reveal that effect of both nanofluid parameters and viscous dissipation is to reduce the heat transfer rate.

Nomenclature

B_0	Uniform magnetic field
b	A positive constant
C	Nanoparticle volume fraction
C_w	Nanoparticle volume fraction at sheet
C_{fx}	Skin friction coefficient
D_B	Brownian diffusion coefficient
D_T	Thermophoretic diffusion coefficient
Ec	Eckert number
$f(\eta)$	Dimensionless stream function
$h(t)$	Film thickness
k	Thermal conductivity of base fluid
M	Hartmann number
Nb	Brownian motion parameter
Nt	Thermophoresis parameter
Nu_x	Local Nusselt number
Pr	Prandtl number
p	Pressure
Re_x	Local Reynolds number
S	Unsteadiness parameter
Sc	Schmidt number
Sh_x	Local Sherwood number
T	Fluid temperature
T_w	Temperature at the sheet
T_r	Reference temperature
U_w	Velocity of the stretching sheet
u, v	Velocity components along the x and y directions, respectively
x, y	Cartesian coordinates along the sheet and normal to it, respectively.

Greek symbols

α	Thermal diffusivity of the base fluid
β	Dimensionless film thickness
ϕ	Dimensionless nanoparticle volume fraction
η	Similarity variable
θ	Dimensionless temperature
μ	Dynamic viscosity of the base fluid
ν	Kinematic viscosity of the base fluid
σ	Electrical conductivity
ρ_f	Density of base fluid
ρ_p	Nanoparticle mass density
$(\rho c)_f$	Heat capacity of the base fluid
$(\rho c)_p$	Heat capacity of the nanoparticle material
τ	$(\rho c)_p/(\rho c)_f$
ψ	Stream function

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Full length article

Evaluation of *in vitro* inhibitory effect of enoxacin on *Babesia* and *Theileria* parasites

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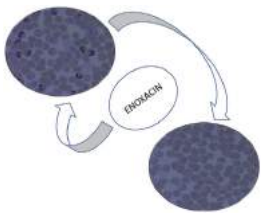
HIGHLIGHTS

- Enoxacin is a broad-spectrum antibacterial agent.
- Enoxacin potently inhibited the *Babesia* and *Theileria* parasites.
- Enoxacin might be used as a treatment for *Babesia* and *Theileria* parasites.

GRAPHICAL ABSTRACT



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ABSTRACT

Enoxacin is a broad-spectrum 6-fluoronaphthyridinone antibacterial agent (fluoroquinolones) structurally related to nalidixic acid used mainly in the treatment of urinary tract infections and gonorrhea. Also it has been shown recently that it may have cancer inhibiting effect. The primary antibabesial effect of Enoxacin is due to inhibition of DNA gyrase subunit A, and DNA topoisomerase. In the present study, enoxacin was tested as a potent inhibitor against the *in vitro* growth of bovine and equine Piroplasms. The *in vitro* growth of five *Babesia* species that were tested was significantly inhibited ($P < 0.05$) by micro molar concentrations of enoxacin (IC_{50} values = 33.5, 15.2, 7.5 and 23.2 μM for *Babesia bovis*, *Babesia bigemina*, *Babesia caballi*, and *Theileria equi*, respectively). Enoxacin IC_{50} values for *Babesia* and *Theileria* parasites were satisfactory as the drug is potent antibacterial drug with minimum side effects. Therefore, enoxacin might be used for treatment of Babesiosis and Theileriosis especially in case of mixed infections with bacterial diseases or incase of animal sensitivity against diminazin toxicity.

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ORIGINAL ARTICLE

In Vitro Scolicidal Effects of *Salvadora persica* Root Extract against Protoscolices of *Echinococcus granulosus*

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Abstract: It has been known that Arak, *Salvadora persica*, has a number of medicinal properties. We tried to investigate in vitro scolicidal effect of root extracts of this plant against protoscolices from hydatid cysts of *Echinococcus granulosus*. Protoscolices were aseptically collected from sheep livers containing hydatid cysts. *S. persica* root extract was used in 10, 30, and 50 mg/ml concentration for 10, 20, and 30 min. The viability of protoscolices was ascertained by 0.1% eosin staining. Scolicidal activity of *S. persica* extract at a concentration of 10 mg/ml was 36.3%, 50.3%, and 70.8% after 10, 20, and 30 min of exposure, respectively. The scolicidal effect of this extract at a concentration of 30 mg/ml was 52.9%, 86.7%, and 100% after 10, 20, and 30 min of exposure, respectively. *S. persica* extract at a concentration of 50 mg/ml, meanwhile, killed 81.4%, 100%, and 100% of protoscolices after 10, 20, and 30 min, respectively. Also, the cytotoxic potential of *S. persica* was assessed on human liver cells (HepG2) using trypan blue exclusion test. No cytotoxic effect was observed on HepG2 cell line. The present study confirmed for the first time that the ethanolic extract of *S. persica* has high scolicidal power in vitro. However, in vivo effect of this material remains to be studied for treatment of echinococcosis in humans and herbivorous animals.

Key words: *Echinococcus granulosus*, hydatidosis, sheep, liver, Arak, scolicidal agent, cytotoxicity

INTRODUCTION

Echinococcosis or hydatidosis is a serious zoonotic infection with a worldwide distribution, caused by larval stages of cestodes belonging to the genus *Echinococcus* [1]. Infection with *Echinococcus granulosus*, the causative agent of cystic echinococcosis, is found on all continents, with the highest prevalence in parts of Eurasia (especially Mediterranean countries, the Russian Federation and adjacent independent states, and China), north and east Africa, Australia, and South America [2]. Hydatid cysts of *E. granulosus* develop in internal organs (mainly the liver and lungs) of humans and other intermediate hosts as unilocular fluid-filled bladders [3]. Although the initial phase of the infection is always asymptomatic for many years or even permanently [2]. Without efficient treatment, the continuous development of the cyst will ultimately result in organ malfunction and even death in many cases [4].

Currently, there are 3 treatment choices for hydatidosis: surgery, which remains the foremost effective treatment, percutaneous aspiration, and medicinal treatment [5]. Surgery is still the preferred method of treatment but one of the major surgical complications of hydatidosis is the recurrence after operation for primary hydatid disease [6]. The spillage of protoscolices-rich fluid during surgery is a major cause of recurrence and multiple secondary hydatidosis [7]. The use of effective scolicidal agents, while avoiding spilling the cyst contents is an integral part of the surgical technique for this intervention, helping to reduce the risk of spilling viable protoscolices [8]. Many scolicidal agents have been used to inactivate the content of cysts, but most are not safe due to their side effects such as sclerosane cholangititis (biliary tract fibrosis), liver necrosis, and methemoglobinemia [9]. The development of safe and effective new scolicidal agents, especially from natural sources, is therefore of great interest [10].

Arak (*Salvadora persica*) is one of the most commonly used medicinal plants for treatment of rheumatism, leprosy, gonor-

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Brief communication (Original)

Colistin susceptibility of gram-negative clinical isolates from Tamil Nadu, India

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Background: Colistin is one of the oldest antibiotics in the polymyxin group, and is used mostly against gram-negative bacteria. Because of developing resistance among clinical isolates colistin has become an alternative drug for multidrug resistant bacteria.

Objectives: To determine colistin resistance among isolates from Tamil Nadu, India.

Methods: We included 94 gram-negative isolates from two centers in Tamil Nadu in the present study. Isolates were identified by 16S rRNA sequencing. Minimal inhibitory concentrations (MICs) were determined by agar dilution.

Results: The isolates identified at species level included 48 *Escherichia coli*, 9 *Klebsiella pneumoniae,* 10 *Pseudomonas aeruginosa*, 5 *Proteus mirabilis*, 4 *Salmonella enterica*, 3 *Enterobacter hormaechei*, 3 *Enterobacter cloacae*, 2 *Achromobacter xylosoxidans*, 2 *Acinetobacter baumannii*, 1 *Providencia vermicola*, 1 *Acinetobacter towneri*, 1 *Enterobacter gergoviae*, 2 *Providencia rettgeri*, 1 *Enterobacter asburiae*, 1 *Pseudomonas stutzeri*, and 1 *Salmonella typhi*. The MIC of colistin ranged from 0.12 μg/ml to 128 μg/ml. The MIC_{50} was 1 μg/mL and MIC_{90} was >128 μg/ml. The MIC ≥ 8 μg/mL was resistant breakpoint for all the species. A total of 27 isolates were resistant to colistin. Colistin resistant isolates included *E. coli* (9/48), *K. pneumoniae* (6/9), *P. aeruginosa* (3/10), *A. baumannii* (1/2), *P. mirabilis* (4/5), *E. cloacae* (1/3), *P. rettgeri* (2/2), and *S. enterica* (1/4). Carbapenem susceptibility of colistin resistant isolates was tested and 14 were found to be resistant to meropenem.

Conclusions: Our study indicates the emergence of colistin resistant isolates from clinical samples among different groups of gram-negative organisms. Resistance to both carbapenem and colistin occurs. Developing new antibiotics and programs to reduce nosocomial infections is necessary especially for multidrug resistant isolates.

Keywords: Antimicrobial agents, gram negative, multi-drug resistant, pathogenesis, polymyxin

Bacterial resistance towards antibiotics is a clinical threat because it increases the problem of infectious disease. Concern regarding multidrug resistant (MDR) bacteria, especially nosocomial pathogens is attracting more interest because new drugs to overcome resistant bacteria in the drug development pipeline are not readily available [1]. Morbidity and mortality because of gram-negative MDR nosocomial pathogens is high [2, 3]. Because of irrational use of antibiotics pathogens can develop and share resistance to common antimicrobials and the development of new drugs appears distant [4]. This growing resistance has rekindled interest in colistin, one of the oldest antibiotics [5]. Colistin is in the polymyxin group of antibiotics, and was available for clinical use from 1959, although it was not always the first preferred drug for many years [6, 7]. The use of colistin against panresistant nosocomial infections caused especially by *Pseudomonas* and *Acinetobacter* spp. has been reported recently [8-12]. The mechanism of action for this bactericidal drug involves the disruption of the outer cell membrane by completely displacing divalent

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(k,s)-Riemann-Liouville fractional integral and applications

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Abstract

In this paper, we introduce a new approach on fractional integration, which generalizes the Riemann-Liouville fractional integral. We prove some properties for this new approach. We also establish some new integral inequalities using this new fractional integration.

Keywords: Riemann-Liouville fractional integrals, synchronous function, Chebyshev inequality, Hölder inequality.

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1. Introduction

Fractional calculus and its widely application have recently been paid more and more attentions. For more recent development on fractional calculus, we refer the reader to [7, 12, 15, 16, 19]. There are several known forms of the fractional integrals of which two have been studied extensively for their applications [5, 10, 11, 14, 21]. The first is the Riemann-Liouville fractional integral of $\alpha \geq 0$ for a continuous function f on $[a,b]$ which is defined by

$$J_a^\alpha f(x) = \frac{1}{\Gamma(\alpha)} \int_a^x (x-t)^{\alpha-1} f(t)dt, \quad \alpha \geq 0, \ a < x \leq b.$$

This integral is motivated by the well known Cauchy formula:

$$\int_a^x dt_1 \int_a^{t_1} dt_2 ... \int_a^{t_{n-1}} f(t_n)dt_n = \frac{1}{\Gamma(n)} \int_a^x (x-t)^{n-1} f(t)dt, n \in \mathbb{N}^*.$$

The second is the Hadamard fractional integral introduced by Hadamard [9]. It is given by:

$$J_a^\alpha f(x) = \frac{1}{\Gamma(\alpha)} \int_a^x \left(\log \frac{x}{t}\right)^{\alpha-1} f(t)\frac{dt}{t}, \quad \alpha > 0, \ x > a.$$

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Full Paper

UNSTEADY MHD FLOW OF SOME NANOFLUIDS PAST AN ACCELERATED VERTICAL PLATE EMBEDDED IN A POROUS MEDIUM

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Abstract

The present paper deals with the unsteady magnetohydrodynamics (MHD) flow and heat transfer of some nanofluids past an accelerating infinite vertical plate in a porous medium. Water as conventional base fluid containing three different types of nanoparticles such as copper (Cu), aluminum oxide (Al_2O_3) and titanium oxide (TiO_2) are considered. By using suitable transformations, the governing partial differential equations corresponding to the momentum and energy are converted into linear ordinary differential equations. Exact solutions of these equations are obtained with the Laplace Transform method. The influence of pertinent parameters on the fluid motion is graphically underlined. It is found that the temperature of Cu-water is higher than those of Al_2O_3-water and TiO_2-water nanofluids.

Keywords: MHD flow, nanofluid, accelerating plate, porous medium

Abstrak

Karya ini berkaitan dengan aliran magnetohidrodinamik (MHD) tak mantap dan pemindahan haba bagi sesetengah bendalir nano melepasi plat menegak tak terhingga memecut tak terhingga dalam medium berliang. Air sebagai bendalir lazim asas mengandungi tiga jenis nano zarah berbeza iaitu kuprum (Cu), aluminium oksida (Al_2O_3) dan titanium oksida (TiO_2) dipertimbangkan. Dengan menggunnakan penjelmaan yang sesuai, persamaan menakluk pembezaan separa berkaitan dengan momentum dan tenaga di gubah kepada persamaan pembezaan linear biasa. Penyelesaian tepat bagi persamaan ini diperoleh dengan kaedah penjelmaan Laplace. Pengaruh bagi parameter berkaitan terhadap pergerakan bendalir digariskan secara grafik. Didapati bahawa suhu air-Cu lebih tinggi daripada bendalir nano bagi air-Al_2O_3 dan air-TiO_2.

Kata kunci: Aliran MHD, bendalir nano, plat memecut, medium berliang

1.0 INTRODUCTION

The heat transfer fluids such as water, engine oil and ethylene glycol have limited heat transfer capabilities due to their low thermal conductivity. Different ways have been used to increase the convective heat transfer performance of the these fluids such as changing flow geometry, boundary conditions, or by increasing thermal conductivity. It is also true that metals have higher thermal conductivities than fluids. Thermal conductivity can be increased by the adding metals to the base fluids. The resultant fluids are termed as nanofluids. This classical idea was first introduced by Choi [1]. Nanofluids are solid-liquid

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Acoustic relaxation of some lithium borate tungstate glasses at low temperatures

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ABSTRACT

The longitudinal ultrasonic attenuation in $20Li_2O–(80\text{-}x)\ B_2O_3–xWO_3$ ($0 \le x \le 12.5$) glass system, was measured using pulse echo technique at ultrasonic frequencies 2, 4, 6 and 14 MHz in the temperature range from 150 to 300 K. The absorption curves showed the presence of well-defined broad peaks at various temperatures depending upon the glass composition and operating frequency. The maximum peaks move to higher temperatures with the increase of operating frequency indicating the presence of some kind of relaxation process. This process has been described as a thermally activated relaxation process which occurs when ultrasonic waves disturb the equilibrium of an atom vibrating in a double-well potential in the glass network structure. Results proved that the average activation energy of the process is mainly depending on the modifier content. This dependence was analyzed in terms of the loss of standard linear solid type, with low dispersion and a broad distribution of Arrhenius type relaxation with temperature independent relaxation strength. The experimental acoustic activation energy has been quantitatively analyzed in terms of the number of loss centers (number of oxygen atoms that vibrate in the double well potential).

1. Introduction

Recently borate glasses get more interest due to their useful physical properties [1–4]. Borate glasses have been used as electro-optic switches, electro-optic modulators, non-linear parametric converters and solid state laser materials. On the other hand, borate glasses show high transparency, low melting point, high thermal stability and good glass forming nature [5,6]. The structure of the borate glasses is not a random distribution of BO_3 triangle and BO_4 tetrahedra. But a gathering of these units forms well defined and stable borate groups such as diborate, triborate, and tetraborate that constitute the three-dimensional random network [6].

Longitudinal and shear ultrasonic wave velocities have been measured by Gaafar et al. [7] in different compositions of the glass system $20Li_2O–(80x)B_2O_3–xWO_3$ ($0 \le x \le 12.5$ mol%), at room temperature and at 4 MHz frequency. The longitudinal ultrasonic wave velocity measurements showed a bend at about 2.5 mol % WO_3 content while shear ultrasonic wave velocity decreased monotonously with an increase of WO_3 content. Elastic moduli values decreased as WO_3 content increased from 0 to 2.5 mol%. Further increase of WO_3 beyond 2.5 mol% increased the elastic moduli values. They suggested that these behaviors are mainly due to the presence of WO_3 in the network structure of these glasses as a network modifier when WO_3 content is between 0 and 2.5 mol%, and acts as a network former above 2.5 mol%.

New approach to the understanding of the structural relaxation of metallic glasses based on the interstitialcy theory has been presented by Khonik [8]. The key hypothesis of this theory proposed by Granato consists of the statement that the thermodynamic properties of crystalline, liquid and glassy states are closely related to the interstitial defects in the dumbbell (split) configuration, called also interstitialcies. It has been argued that structural relaxation of metallic glasses takes place through a change of the concentration of interstitialcy defects frozen-in from the melt upon glass production. Because of a strong interstitialcy-induced shear softening, the defect concentration can be precisely monitored by measurements of the unrelaxed shear modulus. Depending on the relation between the current interstitialcy concentration c and

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Human milk miRNAs primarily originate from the mammary gland resulting in unique miRNA profiles of fractionated milk

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Human milk (HM) contains regulatory biomolecules including miRNAs, the origin and functional significance of which are still undetermined. We used TaqMan OpenArrays to profile 681 mature miRNAs in HM cells and fat, and compared them with maternal peripheral blood mononuclear cells (PBMCs) and plasma, and bovine and soy infant formulae. HM cells and PBMCs (292 and 345 miRNAs, respectively) had higher miRNA content than HM fat and plasma (242 and 219 miRNAs, respectively) ($p < 0.05$). A strong association in miRNA profiles was found between HM cells and fat, whilst PBMCs and plasma were distinctly different to HM, displaying marked inter-individual variation. Considering the dominance of epithelial cells in mature milk of healthy women, these results suggest that HM miRNAs primarily originate from the mammary epithelium, whilst the maternal circulation may have a smaller contribution. Our findings demonstrate that unlike infant formulae, which contained very few human miRNA, HM is a rich source of lactation-specific miRNA, which could be used as biomarkers of the performance and health status of the lactating mammary gland. Given the recently identified stability, uptake and functionality of food- and milk-derived miRNA *in vivo*, HM miRNA are likely to contribute to infant protection and development.

Human milk (HM) is the optimal nutrition for term infants[1]. In addition to being a food source, HM confers developmental programming to the infant and protection against infections, resulting in decreased risk of sudden infant death syndrome and reduced mortality and morbidity both in the short- and long-term[2–6]. These effects are mediated by HM-specific regulatory factors including both cellular and biochemical components[7–10]. In contrast, artificial infant formula cannot confer such protective and developmental functions as it lacks important HM components with bioactivity[11,12]. An additional unique bioactive component of HM that has been recently discovered is miRNAs[13,14].

miRNAs are small non-coding RNAs, which regulate gene expression, thus control protein synthesis at the post-transcriptional level in eukaryotic cells[15]. They have been identified as key regulators of diverse biological and developmental processes in eukaryotes (cell proliferation and differentiation, apoptosis, immune system development and immune response[16,17]) by targeting messenger RNA (mRNA) during its translation into protein, either degrading the mRNA or inhibiting the translation process[18]. Aberrant miRNA expression has been found to be associated with pathologies, including different types of cancer, inflammation and diabetes[19]. Importantly, food-derived miRNA have been recently shown to be very stable in the gastrointestinal tract and be transferred to the blood circulation of adults, influencing gene expression in different tissues[20]. In addition to tissues and cells, miRNAs have been isolated from body fluids, such as plasma, urine, saliva and tears[14]. Further, exosomes, small cell-derived vesicles present in body fluids and carrying proteins and molecules, have been shown to take up miRNAs mediating their protection against digestion and facilitating their regulatory functions in different tissues and organs[21].

Most recently, miRNAs have been isolated in high quantities from both animal and HM, and were shown to be present both as free molecules in skim milk[13,14,22–24] and packaged in vesicles such as milk exosomes and the

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Toward a better parameterization of nuclear density for α-decay calculation

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Abstract

Starting from three-parameter Fermi distribution of nuclear densities, we used two formulas, for calculating the half-density radius, to study the effect of variation of radius of daughter nucleus on both α-decay half-life and α-preformation factor. We compared the results of the aforementioned two formulas with the corresponding results obtained from the nuclear densities of Hartree–Fock calculation derived from the BSk2 Skyrme force. We considered >60 isotopes of Po and Rn α-emitter elements and studied the variation of half-life and preformation factor with density parameters. We found that the variation of density parameters of daughter nuclei highly affects the calculated half-life and the extracted value of preformation factor, but the behavior of these two quantities with variation of parent neutron number is almost independent of the density parameters.

Keywords: Nucleon distributions; α-Decay; Preformation factor; Central depression

1. Introduction

The research on α-radioactivity began with Henri Becquerel's work in 1896 [1,2]. The understanding of α-radioactivity increased with the development of quantum mechanics. In 1928, Gamow [3] and Condon and Gurney [4] independently applied quantum mechanics to nuclear

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Economic production quantity in batch manufacturing with imperfect quality, imperfect inspection, and destructive and non-destructive acceptance sampling in a two-tier market

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ABSTRACT

This article develops an economic production quantity (EPQ) model for the case where the production process and inspection are both not perfect. Unlike the models in the literature, the proposed model aims to find the optimal lot size for a manufacturer who produces items in batches; and the batches are subjected to destructive or non-destructive acceptance sampling process before batches can be sent out to the market. The manufacturer can use destructive testing or non-destructive testing that can best assess the primary quality characteristic. Two errors can happen in this stage: Type 1 and Type 2 errors. If a lot is rejected, it goes through a more expensive non-destructive screening stage to segregate items into non-defective, reworkable, and salvage. Items that reach the primary market and found to be defective are returned, with a return cost to the manufacturer; in this case, returned items are either reworked or sold as salvage. The expected net profit function consists of the following components: primary and secondary market sales, sales of salvage items, setup and variable production cost, return cost, rework cost, screening cost, destructive cost, work-in-process, sales items inventory, rework item inventory, and salvage inventory. For both destructive and non-destructive testing situations, the optimal lot size has been found and the optimality criterion has been tested. The article concludes with a numerical example and sensitivity analysis.

1. Introduction

The classical economic production quantity model has been extended to consider more realistic cases. Advances in the research on the lot size problem can be found in Andriolo, Battini, Grubbström, Persona, and Sgarbossa (2014), Cárdenas-Barrón, Chung, and Treviño-Garza (2014), and Glock, Grosse, and Ries (2014). One particular focus of research by scientists is the consideration of the imperfect production process in determining the EPQ/EOQ value. The earliest articles in the study of the effect of the imperfect production process on the EPQ/EOQ are of Rosenblatt and Lee (1986) and Porteus (1986). The literature that treats inventory models with imperfect quality can be broadly classified into two categories: predictable or unpredictable identification of defective items. The literature on the predictable identification of the quality of items is rich. The EPQ model of Salameh and Jaber (2000) considers imperfect items, which can be identified by a screening process and accumulated into a single batch to be sold at the end of the production cycle. Any reviewer of this article must refer to the correction outlined in Cárdenas-Barrón (2000). Goyal and Cárdenas-Barrón (2002) take on the model of Salameh and Jaber (2000) and propose a simple approach for determining the lot size. Recently, Chiu, Lin, Wu, and Yang (2011) and Chiu, Lin, and Chang (2012) propose an EPQ model with multiple deliveries and known proportion of defective items. The production process is followed by a screening stage; the identified defective items are either scrap or reworkable items. Cárdenas-Barrón, Treviño-Garza, Taleizadeh, and Pandian (2015) solve the previous models with integer values for the lot size and the number of shipments. Chiu, Liu, Chiu, and Chang (2011) develop a model to determine the optimal EMQ in an environment where random defects occur and the rework is performed at the end of the production cycle before the lot can be shipped out. The EPQ model of Hu, Xu, and Guo (2011) assumes fuzzy defective rate with two cases of screening rates. Roya, Sanab, and Chaudhuric (2011) study the effect of the inspection time on the stockout and the resulting back ordering in the case of imperfect quality. Al-Salamah and Alsawafy (2012) consider an EOQ model for lots having fractions of scrap and reworkable items; and the demand is satisfied from perfect and reworked items; and the scrap items

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Room temperature spin valve effect in NiFe/WS_2/Co junctions

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The two-dimensional (2D) layered electronic materials of transition metal dichalcogenides (TMDCs) have been recently proposed as an emerging canddiate for spintronic applications. Here, we report the exfoliated single layer WS_2-intelayer based spin valve effect in NiFe/WS_2/Co junction from room temperature to 4.2 K. The ratio of relative magnetoresistance in spin valve effect increases from 0.18% at room temperature to 0.47% at 4.2 K. We observed that the junction resistance decreases monotonically as temperature is lowered. These results revealed that semiconducting WS_2 thin film works as a metallic conducting interlayer between NiFe and Co electrodes.

Two-dimensional (2D) nanomaterials have been already established to have prodigious potential for application in the field of spintronics[1–9]. The 2D transition-metal dichalcogenides (TMDCs) have attractive properties such as bandgap, atomically thin layered structure and a promising material for active channel in field-effect transistor applications. In particular, tungsten- and molybdenum-based TMDC are attracting materials due to semiconducting and optoelectronics properties[10–12]. The tungsten disulfide (WS_2) has a fascinating property that it shows direct bandgap for monolayer while have indirect bandgap for bulk. The bulk WS_2 have an indirect bandgap (1.4 eV) but goes to a direct bandgap (2.1 eV) material when exfoliated into the monolayer[13]. The structure of single layer of WS_2 crystals is formed by covalently bonded in-plane S-W-S atoms, which contain of two sheets of S atoms and one sheet of W atoms and are hexagonally packed. In general wide band gap oxides such as Al_2O_3[14–16] or MgO are previously being utilized as a nonmagnetic spacer in spin valve devices[17–21]. The basic principal of spin valve comprises of two ferromagnetic metal layers decoupled by a non-magnetic insertion, which permits parallel and antiparallel alignment of the magnetizations of two magnetic layers. The magnetoresistance of a spin valve can be determined from the magnetization alignment configuration between two ferromagnetic electrodes and controlled by the external magnetic field. Recently, there has been extensive interest in the spin-dependent properties of 2D materials such as: graphene, hexagonal boron nitride, molybdenum disulfide and it became more incorporative platform for non-magnetic interlayer spacer between two ferromagnetic electrodes in current perpendicular to plane spin valve device structures[1,6,7]. There have been efforts to explore a variety of new spin valve structures of 2D materials with single interlayer spacer to few layers[1–9], and further continue to be fully investigated for new materials.

Here, we report on the first fabrication and characterization of tungsten disulfide based spin valve effect in the junction comprising top electrode (Co) and bottom electrode of Permalloy (Py, $Ni_{81}Fe_{19}$) film and WS_2 as an interlayer. The magnetoresistance show two resistance states depending on the magnetization alignment configuration between two electrodes. The spin valve signals are observed from room temperature to 4.2 K and having magnetoresistance ratios of 0.18% at 300 K to 0.47% at 4.2 K. We have also studied the basic functionality of semiconducting WS_2 film junction resistance as function of temperature.

Results and Discussion

Characterization of WS_2 spin valve. Figure 1(a) shows a schematic of WS_2 spin valve consisting of top Co electrode, bottom NiFe electrode and a WS_2 interlayer. The device structure and the measurement configuration are shown in Fig. 1(b). While current flows from Co to NiFe through WS_2 interface, voltage is measured between Co and NiFe. The in-plane magnetic field *(H)* was applied at 45° to the direction of the ferromagnetic (FM)

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ORIGINAL ARTICLE

Three dimensional boundary layer flow of a viscoelastic nanofluid with Soret and Dufour effects

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KEYWORDS

Soret Dufour effects;
Viscoelastic fluid;
Nanoparticles;
Nonlinear analysis

Abstract The present research focuses on the three-dimensional flow of viscoelastic fluid in the presence of Soret and Dufour effects. Effects of thermophoresis and Brownian motion are taken into account. Appropriate similarity transformations lead to nonlinear ordinary differential equations. Solution expressions of velocity, temperature and nanoparticle concentration are computed via homotopy analysis method (HAM). Convergence of obtained solutions is analyzed graphically and numerically. Results are plotted and analyzed for the dimensionless velocities, temperature and nanoparticle concentration. Values of local Nusselt and Sherwood numbers are examined through tabular form. It is observed that Temperature field is enhanced for the larger Brownian motion parameter and an increase in Dufour number gives rise to the temperature and thermal boundary layer thickness.

1. Introduction

Heat transfer mechanism has an important role in many engineering and industrial fields because cooling and heating processes are involved in such fields. An increase in heat transfer rate is quite essential. It reduces the process time of work and length of the work life of equipment. Various methods are proposed in the past to increase the heat transfer efficiency rate. Some methods involve extended surfaces, applications of vibration to the heat transfer surfaces and usage of micro-channels is studied by Kwak and Kim [1]. There is another method to increase the heat transfer efficiency by increasing the thermal conductivity of the working fluids as mentioned by Ramzan [2]. Most commonly used working fluids such as water, engine oil, and ethylene glycol have lower thermal conductivity compared to the thermal conductivity of solids. Solids of higher thermal conductivity can be utilized to increase the thermal conductivity of the base fluid by emerging small solid particles in the fluid. Emerging of such particles in the base fluid is known as nanofluid. Such fluids have several applications in biomedical and engineering applications in cooling, cancer therapy and process industries. A tremendous work on nanofluids can be seen in Refs. [3–12].

The boundary layer flow over a continuously stretching surface is commonly encountered in various industrial and

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Original Article

Original Article

Antifungal Susceptibility and Phylogeny of Opportunistic Members of the Genus *Fusarium* Causing Human Keratomycosis in South India

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Abstract

Fusarium species are reported frequently as the most common causative agents of fungal keratitis in tropical countries such as India. Sixty-five fusaria isolated from patients were subjected to multilocus DNA sequencing to characterize the spectrum of the species associated with keratitis infections in India. Susceptibilities of these fusaria to ten antifungals were determined *in vitro* by the broth microdilution method. An impressive phylogenetic diversity of fusaria was reflected in susceptibilities differing at species level. Typing results revealed that the isolates were distributed among species in the species complexes

Efficient Reluctance Network Formulation for Modeling Design and Optimization of Linear Hybrid Motor

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The aim of this paper is to propose an efficient and unique reluctance network (RN) model for all translator displacements of a linear hybrid motor. This model has to consider several translator positions to analyze the linear motor performances. The proposed RN model takes into account the magnetic characteristic and the flux leakage. Consequently, the proposed model gives precise results of the electromagnetic characteristic. The RN model considers an interesting solution to deal quickly with an optimization task of a large number of constraints and parameters. The developed model is coupled with sequential quadrating programming method for an optimization process of the linear machine. The obtained results confirm the efficiency of this method for modeling and optimization of the linear machine.

***Index Terms*— Electromagnetic analysis, magnetic flux, magnetic forces, optimization, reluctance network (RN).**

I. Introduction

THE LINEAR hybrid motors (LHMs) consist of an efficient solution for precise linear displacements applications [1]. Many research papers work on the design and the optimization of these machines [2]. The finite element method (FEM) is generally used when precise results are indispensable [3]. However, this method needs large computation time, limiting the number of parameters that can be taken into account. Moreover, the FEM cannot be coupled with rapid optimization algorithms [4]. The second method used in the design of linear machines is based on the reluctance network (RN) model [3]–[5]. In this paper, we are concerned with the development of a new RN model for modeling and optimization of linear machines. A 3-D view of the studied machine is shown in Fig. 1. The main dimensions of the proposed LHM are shown in Fig. 2.

The double-sided LHM mechanical dimensions are summarized in Table I.

In Section II, a unique RN model for all translator positions is presented and discussed. The comparison of results with that of the FEM is presented in Section III. The optimization of the machine is presented and discussed in Section IV. The optimization task consists in reducing the global mass of the machine. The electromagnetic characteristics of the optimized structure are also presented and verified using the FEM. The conclusions and perspectives are given in Section V.

II. Unique Reluctance Network Model for All Displacements

The concept is based on the subdivision of the magnetic circuit of the machine into a sufficient number of elements known as flux tubes. Each flux tube is associated with a magnetic reluctance, which depends on circuit dimension and the magnetic behavior. The originality of this model consists

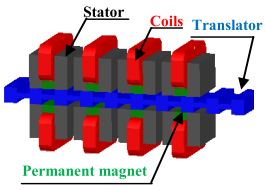

Fig. 1. Double-sided hybrid motor.

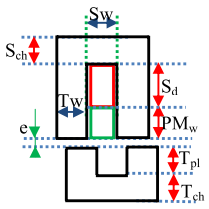

Fig. 2. Geometrical dimensions.

TABLE I
LHM Design Specifications

Quantity	Symbol	Values
Tooth width	Tw	50 mm
Air gap width	e	1 mm
Translator thickness	Tt	200 mm
Translator pole length	Tpl	20 mm
Translator cylinder head	Tch	20 mm
Current excitation	I	6A
Turns per phase	N	1500

Manuscript received July 6, 2015; revised October 16, 2015; accepted October 27, 2015. Date of publication November 2, 2015; date of current version February 17, 2016. Corresponding author: E. M. Barhoumi (e-mail: e.barhoumi@mu.edu.sa).

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An Accelerated Architecture Based on GPU and Multi-Processor Design for Fingerprint Recognition

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***Abstract*—Fingerprint recognition is widely used in security systems to recognize humans. In both industry and scientific literature, many fingerprint identification systems were developed using different techniques and approaches. Although the number of conducted research works in this field, developed systems suffer for some limitations partially those related the real time computation and fingerprint recognition. Accordingly, this paper proposes a reliable algorithm for fingerprint recognition based on the extraction and matching of Minutiae. In this paper, we present also an accelerated architecture based on GPU and multi-processor design in which the suggested fingerprint recognition algorithm is implemented.**

***Keywords*—Minutia; Fingerprint; Architecture design; recognition; Gabor filter; MPSOC**

I. Introduction

Individual identification presents a challenge for the modern society. In this context, biometric recognition presents the most popular method for identification. Particularly, fingerprint technique is the most used in industries for many reasons: cheap, secure and easy to deploy. Fingerprints are rich in details and contain a different form based on ridges. These forms define many characteristics point named "Minutia". Each individual has unique repartition of Minutia which is different than others. Consequently, fingerprint is always used in many systems as the identifier of humans. Minutia is defined as a local ridge characteristic. Fingerprint contains various types of Minutia, but usually two types of Minutiae are used: Termination and Bifurcation. Termination is defined as the end point of a ridge. Bifurcation is defined as the point where a ridge merges or splits into branch ridges [1].

A. Fingerprint recognition process

In the scientific literature, the process of fingerprint recognition is always divided to different phases including: the pre-processing, the extraction of the Minutiae and the matching (see Fig. 1).

The objective of the first phase, the pre-processing, is applied on gray-scale images essentially to improve and divide fingerprints ridges from the background texture. The first step is to apply a filter algorithm. This step is important to ameliorate the quality of the image and to decrease noise [2]. Then the binarization step transforms the image into binary and lets the separation between ridges and background easier. The last step in the pre-processing step is the skeletonization which is based on thinning algorithms. The aim of this step is to thin ridges to only 1 pixel wide. This preserves the essential information (Minutiae) with low size of storage. Also thinning algorithms reduces the data that represents Minutiae and make the treatment more effective and faster. In the scientific literature, there are many iterative methods for thinning including sequential [49] or parallel [3]. In this step, the most used window size is a 3X3 pixel. In this case the central black pixel has 8 neighbours that can be considered [3].

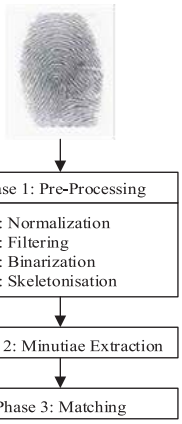

Fig. 1. Fingerprint recognition phases

The second phase is the extraction of the Minutiae. Many extraction methods were developed including those based on the nearest neighbour pixels around the central pixel [4]. Another method of extraction Minutia is presented in [5] which search the characteristics point Minutiae using thinned ridges. Other algorithms were based on classifier techniques [20]. [6, 7] tried to detect Minutiae using the ridge line without apply the thinning algorithms. In these works, different rules and ad-hoc methods are used to handle problems met on extraction. The extraction method proposed in [8] is based on Data-driven Error Correcting Output Coding (DECOC) classifier. This method presents a many advantages with other methods used. However, the outputs results depend not only on selected extraction algorithm but also on the pre-processing phase essentially binarization and skeletonization.

Matching phase aims to carry out fingerprint verification

PLOS | ONE

RESEARCH ARTICLE

Photodynamic Effect of Ni Nanotubes on an HeLa Cell Line

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Abstract

Nickel nanomaterials are promising in the biomedical field, especially in cancer diagnostics and targeted therapy, due to their distinctive chemical and physical properties. In this experiment, the toxicity of nickel nanotubes (Ni NTs) were tested in an *in vitro* cervical cancer model (HeLa cell line) to optimize the parameters of photodynamic therapy (PDT) for their greatest effectiveness. Ni NTs were synthesized by electrodeposition. Morphological analysis and magnetic behavior were examined using a Scanning electron microscope (SEM), an energy dispersive X-ray analysis (EDAX) and a vibrating sample magnetometer (VSM) analysis. Phototoxic and cytotoxic effects of nanomaterials were studied using the Ni NTs alone as well as in conjugation with aminolevulinic acid (5-ALA); this was performed both in the dark and under laser exposure. Toxic effects on the HeLa cell model were evaluated by a neutral red assay (NRA) and by detection of intracellular reactive oxygen species (ROS) production. Furthermore, 10–200 nM of Ni NTs was prepared in solution form and applied to HeLa cells in 96-well plates. Maximum toxicity of Ni NTs complexed with 5-ALA was observed at 100 J/cm^2 and 200 nM. Up to 65–68% loss in cell viability was observed. Statistical analysis was performed on the experimental results to confirm the worth and clarity of results, with p-values = 0.003 and 0.000, respectively. Current results pave the way for a more rational strategy to overcome the problem of drug bioavailability in nanoparticulate targeted cancer therapy, which plays a dynamic role in clinical practice.

1. Introduction

Astonishing, nanotechnology has moved the nano world with its magnificent physiochemical characteristics. It has affected a multitude of areas, including science, technology, energy

Particle Shape and Size Effects on Slurry Erosion of AISI 5117 Steels

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Solid particle shape and size effects on the slurry erosion behavior of AISI 5117 carbon steels are investigated, using whirling-arm ring for two different erodent particles, namely, silica sand (SiO_2) and silicon carbide (SiC). From this work, it was found that aspect ratio and circularity factor (CF) increase for silica sand and decrease for silicon carbide with increasing size. The erosion rate increased with the increase of particle size for the two types of erodent particles and its value was greater in the case of silicon carbide particles. At the same test conditions, it has been noticed that the particle size plays the major role in the slurry erosion of 5117 steels in comparison with the aspect ratio and circularity factor. Microcutting and plowing with serrated wear tracks were observed for coarse SiC particles having irregular and angular shape. But, for coarse SiO_2 particles which had a rounded shape, the main mechanism was plowing with plain and smooth wear tracks for an impact angle of 30 deg. Indentations and material extrusion prevailed for the coarse size of the two erodents for an impact angle of 90 deg. [DOI: 10.1115/1.4031987]

Keywords: slurry erosion, particle shape, particle size, silicon carbide particle, silica sand particle, impingement angle, erosion mechanism, AISI 5117 steel

1 Introduction

Slurry erosion, which is caused by the collision of solid particles suspended liquids with target, causes serious economic losses in many industrial sectors, such as marine, oil and gas production, and mining and power generation. The behavior of this type of wear erosion is still shrouded in mystery because a lot of interlocking and complex factors that control it [1,2]. These factors include erodent particle characteristics, flow field parameters, and target material properties.

One of the main parameters influencing slurry erosion is formed by the properties of the particles causing the damage. According to the literature, the most important particle properties related to slurry erosion are the size, shape, and hardness. Over the years, the exact impact of particle size and shape has constituted a challenging problem that remained open so far.

The effect of particle size on the rate of erosion by slurries has been examined by many investigators [3–7]. They reported that increasing the particle size results in an increased erosion rate which tends to a limiting value, while very small particle sizes result in vanishingly small rates. Abouel-Kasem [8] observed that below 200 μm, the erosion mechanism is indentation and material extrusion, and above 200 μm, the erosion mechanism is plowing for ductile material. This shows that there are contradicting results relating the variation of the wear rate and the related mechanisms with the particle size. Consequently, further investigations are needed to clarify the effect of the particle size on the erosion behavior.

The shapes of particles are of fundamental importance in many areas of engineering and scientific research and, in particular, in tribology. The shape of particles has a major effect in determining particle erosivity, and thus the erosion behavior. Heywood [9] defined the size of a particle by three mutually perpendicular dimensions, namely, the thickness (T), the width (W), and the length (L). These three dimensions are used to define the shape factors, namely, the elongation ratio (L/W) and the flatness ratio (W/T). The reciprocal of elongation ratio, called the aspect ratio (W/L), is also used to describe the particle shape. The values of the aspect ratio range from unity for a particle having circular projected area to zero for a body of a perfect fibrous shape.

Another commonly used shape factor is the CF ($\Phi = 4\pi A/P^2$), developed by Cox [10], where A is the particle area and P is its perimeter. The circularity is equal to unity for circular shape and any deviation away from unity indicates departure from circularity, and accordingly, circularity increases as this parameter gets closer to unity.

Several attempts [11–13] have been made to characterize the particles shape in terms of their angularity, using various techniques and parameters. Hambline and Stachowiak [11] have proposed the spike parameter-linear fit, which is based on the representation of the projected particle boundary by a set of triangles constructed at different scales. Hambline and Stachowiak [12,13] have proposed another parameter for the characterization of the particle shape, which they termed as the spike parameter-quadratic fit (SPQ) which is based on fitting quadratic segments to protruding sections of particle boundary.

Recently, Walker and Hambe [14] have calculated the Φ and SPQ for a wide range of particle shapes (from angular to round) and found a close linear correlation between both of them. They used the Φ in analysis of the effect of particle shape on the erosion of white irons. Their results show that the wear rate decreases with increasing particle Φ and shows an inverse power law relationship with Φ, but specific wear rates will depend additionally on particle size.

It has been reported that [15] the hardness of erodent particles has a crucial effect on the slurry erosion rate. However, the dependence of erosion rate on the particle hardness is much more complex because of the interdependence of shape and hardness where the shape has also been known to influence the erosion significantly. In their work on erosion by a variety of abrasive particles, Goodwin et al. [16] concluded that the hardest particles tended to have the sharpest profile and consequently increased

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Pharmacokinetics and biodistribution of nickel oxide for liver cancer cure

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Abstract

Use of Nickel Oxide (NiO) nanoparticles as photosensitizers has undergone a strong development in the last few years due to their ability and significant bioavailability. NiO NPs are emerging milestones in photodynamic therapy (PDT) ongoing research with diverse marvelous biomedical applications e.g. cancer diagnostic as well as treatment, in many antibacterial and microbial therapy purposes and plays a dynamic role in such applications because of their unique characteristics like size dependent tunable emission spectrum of broad wavelength of light and high quantum yield. At this time, nanodependent PDT technique involving nanoparticles and NRs is effective, sophisticated and up to the mark due to high drug accumulation in the cancerous tissue and normal safety and biosafety.

The main object of current research is improving the efficiency of cancer treatment up to certain limit. In ongoing research experiment NiO NPs were grown by applying co-precipitation method. Manifold techniques were employed for justification of crystalline and morphological analysis. In first step author focused the toxic nature of suggested particles. Secondly, biotoxicity of NiO NPs were tested in hepatocellular model by applying NRA and microscopy. More sophisticated, efficient, effective and rapidly developing technique for cancer treatment is thirst of this modern age. Because many peoples due to this are under attack due to this severe disease. In addition, hepatocellular carcinoma (HepG2) is fifth the most common harmful cancer found in liver cells. Finally actual cell killing effect via necrosis/apoptosis was the big challenge for author. After careful study of toxicity of NiO NPs in HepG2 cellular model the author will be confident to interpret protocol for real treatment of liver cancer patients.

Keywords

Author Keywords:NiO nanoparticles (NiO NPs); HepG2 cell line; Neutral red assay; Photodynamic therapy

KeyWords Plus:NANOPARTICLES; TISSUE

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REVIEW ARTICLE

A review of melanized (black) fungal contamination in pharmaceutical products—incidence, drug recall and control measures*

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Keywords
biocides, fungi, moulds, mycology, pharmaceuticals.

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* In the Virulence factors of black fungi section there have been some changes since first publication.

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Summary

The aim of this study was to describe the incidence of contamination of pharmaceutical products by melanized fungi and to consider control measures in relation to bioburden and cleanrooms. This study reviews and analyses pharmaceutical product recalls and offers incidence rates of fungal detection from a typical cleanrooms. The recalls include some serious cases which resulted in the loss of life. Of different types of fungal contamination incidences some of the most damaging have been due to melanized fungi ('black mould'), such as *Exserohilum rostratum*. The focus of the article is with melanized fungi. The study concludes that, from the review of recent pharmaceutical product recalls, fungal contamination is either increasingly common within cleanroom environments or the accuracy of sampling and the level of reporting has risen. The prevalence of melanized fungi in pharmaceutical facilities rests on specific virulence factors particular to these types of fungi, which are outlined. The article identifies a gap in the way that such fungi are screened for using available cultural methods. The article provides some control strategies, including assessing the suitability of disinfectants and biocides, for reducing the risk of melanized fungal incidences within the pharmaceutical facility. Understanding the fungal risk to pharmaceutical products remains a poorly understood and often overlooked aspect of pharmaceutical microbiology. This article helps to identify this risk and offer some guidance to those involved with pharmaceutical products manufacture in relation to bio-contamination control strategies.

Introduction

Fungi (moulds and yeasts) are an important group of micro-organisms. Fungi are responsible for various infections especially with the immunocompromised host. In addition to their medical importance, these organisms are associated with contamination of surfaces and spoilage of pharmaceutical, cosmetic and food products. Fungal contamination of pharmaceutical products can cause not only serious economic losses to the manufacturer but can also lead to serious health problems to customers (patients) (Pitt and Hocking 1997; Dupont 2002).

Over the years, several mould issues associated with pharmaceutical cleanrooms, cold rooms and controlled areas have been reported. For example, several vaccine and pharmaceutical companies in Europe have experienced an increase in mould contamination due to an increase in ambient temperatures and issues with items brought into cleanrooms (Lopolito *et al.* 2007; Sandle 2011; Vijayakumar *et al.* 2012).

A review of fungal contamination of pharmaceutical products reported by various authors, together with recall data relating to more than 100 pharmaceutical products collated by the Federal Drug Administration (FDA) for the years between 2000 and 2010, shows that contamination by mould and yeast was found in 21% of samples (Jimenez 2007; Vijayakumar *et al.* 2012; Smith *et al.* 2013). More recently in the year of 2012, the most serious event ever—

ORIGINAL ARTICLE

Knowledge, attitude, and practice (KAP) of food hygiene among schools students' in Majmaah city, Saudi Arabia

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Abstract

Objectives: To determine the level of knowledge, attitude, and practice of food hygiene among primary, intermediate and high school students and explore association, if any, with socio-demographic differences.

Methods: The observational cross-sectional study was conducted at boy's schools in Majmaah, Kingdom of Saudi Arabia, from February to May 2014. Data was collected using stratified random sampling technique from students aged 8-25 year. Two schools from each level (primary, intermediate and high school) were randomly selected and data was collected from the selected schools using simple random sampling method. A self-administered modified Sharif and Al-Malki questionnaire for knowledge, attitude and practice of food hygiene was used with Arabic translation.

Results: The mean age of 377 male students in the study was 14.53±2.647 years. Knowledge levels was less in primary school students compared to high school students (p=0.026). Attitude level was high in primary school students compared to intermediate school students (p<0.001). No significant difference was observed between groups with regard to practice levels (p=0.152).

Conclusion: The students exhibited good practice levels, despite fair knowledge and attitude levels.

Keywords: Knowledge, Attitude, Practice, Food hygiene, School health. (JPMA 66: 442; 2016)

Introduction

Food hygiene is an important global public health issue since long. Consumption of unhealthy food is becoming more severe, especially among school children even though various efforts have been made by the authorities. Food hygiene is defined as 'the measures and conditions necessary to control hazards and to ensure fitness for human consumption of a foodstuff taking into account its intended use."[1] Food illnesses are defined as diseases, usually either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food.[2] Global statistics on food-borne diseases showed that cases of food-borne illnesses are increasing year by year. Food poisoning cases are usually reported among school students frequenting school canteens, hostel kitchens and food prepared under the Supplementary Food Programme. The contributing factors in these outbreaks of food poisoning are improper storage or holding temperature and poor personal hygiene.[3] Thus, the prevention of food-borne illnesses requires educating food consumers on safe food handling practices.[4] Education must be provided to increase the level of knowledge. Schools are acknowledged as important places for developing health promotion and influencing health-related behaviours,[5-7] including hygiene-related behaviours. Once habits are established in adolescence, they tend to be long-lasting and difficult to alter in adulthood.[8] Thus, children educated in an effective way whilst at school may become adults who observe good hygiene practices. However, providing knowledge does not necessarily result in behaviour change, with many hygiene education programmes failing to deliver anticipated changes.[9] A variety of poor food hygiene practices have been observed when consumers prepare food at home[10,11] with 95.4% failing to implement one or more basic food hygiene practices as a result of inadequate knowledge or failing to carry out known food safety procedures[12] and that a significant proportion of the public frequently implement unsafe food-handling practices. Study done in Taif University, Saudi Arabia, showed the overall knowledge, attitude and practice (KAP) mean score was 74.78%. However, the mean score for KAP components were 74.95%, 67.26% and 80.29% for knowledge, attitude and practice, respectively.[13] Another study conducted in Ethiopia to assess KAP among school children in Angolela showed that approximately 52% of students were classified as having adequate knowledge of proper hygiene. Most students reported hand-washing before meals 99.0%, but only 36.2% reported using soap.

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Letter to the Editor

Letter to the Editor regarding a study titled "A modified straight leg raise test to differentiate between sural nerve pathology and Achilles tendinopathy. A cross-sectional cadaver study" by Coppieters et al. (2015)

I would like to commend Coppieters et al. (2015) for investigating the variations in strain and excursion of the sural nerve and Achilles tendon during a modified straight leg raise test. Indeed, this article makes an important contribution to the literature on lower limb neural biomechanics as there are not many cadaveric studies in this area.

The authors have used a robust and feasible method to answer the research question. Pragmatically, positioning the cadaver in side-lying appears suitable for doing a modified straight leg raise test. If the reliability of goniometer readings in measuring hip and ankle angles would have been analysed then this would have been an added strength to the study because these measurements are the predictors of strain and excursion in the sural nerve and Achilles tendon in this study. Whether calibration of the strain gauges and digital calliper was done before and/or during the study to determine the accuracy/precision of the equipment was not reported.

The cumulative increase in strain (% or mm?) induced in the sural nerve was 1.2 (0.6) (mean (SD)) with ankle dorsiflexion and 2.1 (0.5) with hip flexion and ankle dorsiflexion. The mean excursion (proximal sliding) of the sural nerve with ankle dorsiflexion was found to be 1.2 mm with a standard deviation of 1.8 mm. Why the standard deviation value (1.8 mm) was larger than the mean value (1.2 mm) should be discussed. As three repetitions were used for documenting strain and excursion of the sural nerve and Achilles tendon, would reporting ICC (2,3) be adequate rather than calculating both ICC (2,1) and ICC (2,3) values? $SEM_{repeated}$ formula (standard error of measurement [SEM] value multiplied by the square root of the number of repetitions) has been recommended for calculating measurement error associated with repeated measures (Domholdt, 2005). This value will be larger than SEM values reported by the authors. Further, calculating smallest real difference or minimal detectable change values at a 95% confidence interval will clarify whether the measured values (outcome measures), which were relatively small in the current study, show a real difference that is free from measurement error.

The authors have discussed that one of the reasons for the poor reliability of the strain measurement of the Achilles tendon following ankle dorsiflexion during the modified straight leg raise test was small inter-cadaver variability when compared to the within-cadaver variation. Was there a lack of consistent and linear relationship between the applied tension or tendon stretch with ankle dorsiflexion and corresponding change in the strain of the Achilles tendon in the cadavers? From Fig. 2, it is evident that the mean strain value of the Achilles tendon with ankle dorsiflexion is negligible (1.4% [0.1%]). If so, discussing the biomechanical behaviour of the Achilles tendon in embalmed cadavers will be useful. In Fig. 2, the scale of the vertical (Y) axis reads as cumulative increase in strain in percentage (%); however, in the discussion section, the standard deviation values of the strain measurements have been reported in mm. This needs further clarification.

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Applied Physics A
Materials Science & Processing

Structural, magnetic and magnetocaloric properties of polycrystalline $La_{0.67}Ba_{0.33-x}Zn_xMnO_3$ ($x = 0.15$ and 0.2) manganites

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Abstract We report on the structural, magnetic and magnetocaloric properties of manganite $La_{0.67}Ba_{0.33-x}Zn_xMnO_3$ ($x = 0.15$ and 0.2). X-ray diffraction studies show that all samples crystallize with the rhombohedral symmetry within the space $R\bar{3}c$. The magnetic and magnetocaloric properties of polycrystalline perovskite were investigated from the measured magnetization data of the samples as a function of the applied magnetic field. The associated magnetic entropy change close to their respective Curie temperature T_C and the relative cooling power (RCP) have been determined. It was found that the maximum change in magnetic entropy of $La_{0.67}Ba_{0.33-x}Zn_xMnO_3$ samples reached 3.4 J/kg K at $T_C = 260$ K for a magnetic field of 5 T and RCP = 223.77 J/kg. In view of these results, $La_{0.67}Ba_{0.33-x}Zn_xMnO_3$ compounds are potential candidates for magnetic refrigeration.

1 Introduction

An immense effort has been devoted to studying the interplay between crystal structure, electrical and magnetic properties in perovskite manganese oxides $La_{1-x}A_xMnO_3$ ($A = Ca^{2+}$, Sr^{2+}, Ba^{2+}, Pb^{2+}, etc.). As a function of temperature, applied magnetic field and doping, this system has a rich phase diagram in the magnetotransport and structural properties, for example, the negative colossal magnetoresistance effect (CMR) and the conventional semiconductor-metal transition. Manganites refer to a known family of manganese oxides, for their potential technological applications in magnetic phase transition, colossal magnetoresistance (CMR) effect as well as magnetocaloric effect (MCE) [1, 2]. The parent compound $LaMnO_3$ is a charge-transferring (CT) semiconductor [3, 4] in which the Mn^{3+} moments form a layered antiferromagnetic structure. The electronic configuration of Mn^{3+} $\left(t_{2g\uparrow}^3 e_{g\uparrow}^1\right)$, where the three $\left(t_{2g\uparrow}\right)$ electrons are lightly bound with a net spin of 3/2. The substitution of divalent ions at the La-site of $La_{1-x}A_xMnO_3$ converts some of the Mn^{3+} ions $\left(3d^4,\ t_{2g\uparrow}^3 e_{g\uparrow}^1, S = 2\right)$ into Mn^{4+} ions $\left(3d^3,\ t_{2g\uparrow}^3 e_{g\uparrow}^0, S = 3/2\right)$, resulting in fascinating physical phenomena, such as paramagnetic (PM) semiconductor to ferromagnetic (FM) metallic or various mixed magnetic phases, viz. canted antiferromagnetic/spin glass coupled with charge/orbital ordered states at a particular doping range. The holes permit charge transfer in the state which is highly hybridized with the oxygen 2*p* state. Due to Hund's rule, this intra-atomic charge transfer refrigerant induces a ferromagnetic coupling between Mn^{3+} and Mn^{4+} ions which in turn has a dramatic effect on the electrical conductivity [5, 6]. This double-exchange (DE) model originally proposed by Zener [7] has been the most prominent underlying physics that describes the simultaneous occurrence of transition from paramagnetic semiconductor to ferromagnetic metal for most hole-doped manganites. The magnetic properties of $La_{1-x}A_xMnO_3$ phases are strongly affected by the Mn–O bond length and Mn–O–Mn bond angle controlled by the ionic radii of La- and Mn-site ions

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ON THE SET OF SUBHYPERGROUPS OF CERTAIN CANONICAL HYPERGROUPS $C(n)$

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Abstract

This paper deals with the set of subhypergroups of the canonical hypergroup $C(n)$ defined as in [7]. Many general results have been proved. The set of all subhypergroups of $C(12)$ has been determined explicitly. This set is a lattice.

1. Introduction

In [10], the author has determined the set of subhypergroups of the three trivial hypergroups. To make the paper self sufficient we express these results and give the proof of one of them. In our case, we are interested by the set of subhypergroups of the canonical hypergroup $C(n)$. We prove that any subhypergroup must contain the identity element. We also determine the conditions on the integer n such that the hypergroup $C(n)$ has a

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Double-Diffusive Forced Convective Boundary Layer Flow in Porous Medium Saturated with Nanofluids Along Horizontal Surface

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Abstract

An analysis is performed to study the problem of double diffusive forced convection boundary-layer flow over a non-isothermal horizontal surface embedded in a porous medium saturated with a water-based nanofluid. The model identifies the Brownian motion and thermophoresis as the primary mechanisms for enhanced convection of the nanofluid. The behavior of the porous medium is described by the Darcy model. The horizontal surface is maintained at a variable temperature, solute concentration and nanoparticle volume fraction in the power law form. The governing partial differential equations are transformed into a set of non-similar equations and solved numerically. Comparisons with previously published work are presented and an excellent agreement is obtained. A parametric study is conducted and a representative set of numerical results for the dimensionless velocity, temperature, concentration, and volume fraction profiles as well as the reduced Nusselt and the two reduced Sherwood numbers is shown graphically to show interesting features of the solutions.

Keywords

Author Keywords:Horizontal Surface; Mixed Convection; Water-Based Nanofluids; Porous Medium; Thermophoresis; Brownian Motion

KeyWords Plus:MIXED CONVECTION; NATURAL-CONVECTION; CIRCULAR-CYLINDER; VERTICAL PLATE; MASS FLUX; HEAT; CONE

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Article

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Synthesis and Photoluminescence of Single-Crystalline Fe(III)-Doped CdS Nanobelts

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In this paper, we report the synthesis and optical properties of Fe(III) doped CdS nanobelts (NBs) via simple Chemical Vapor Deposition (CVD) technique to explore their potential in nano-optics. The energy dispersive X-ray spectroscopy (EDX) and X-ray diffraction (XRD) analysis manifested the presence of Fe(III) ions in the NBs subsequently confirmed by the peak shifting to lower phonon energies as recorded by Raman spectra and shorter lifetime in ns. Photoluminescence (PL) spectrum investigations of the single Fe(III)-doped CdS NBs depicted an additional PL peak centered at 573 nm (orange emission) in addition to the bandedge(BE) emission. The redshift and decrease in the BE intensity of the PL peaks, as compared to the bulk CdS, confirmed the quenching of spectra upon Fe doping. The synthesis and orange emission for Fe-doped CdS NBs have been observed for the first time and point out their potential in nanoscale devices.

Keywords: CdS, Nanobelts, Fe(III) Doping, Chemical Vapor Deposition, Photoluminescence.

1. INTRODUCTION

Nanostructures deliberately doped with transition metals (TM) like Mn, Ni, Co and Fe, in very small fractions, give birth to dilute magnetic semiconductors (DMSs).[1] DMSs show interesting optical[2] and electrical[3,4] properties due to the spin-orbit interactions between the dopant ions and the host charge carriers (*s*, *p-d* exchange interactions),[5,6] thus leading to their possible application in spintronics.[7] The very roots of such wide functionalities lie in the basic idea that spin is itself a very important characteristic and imparts unique characteristics to the nanomaterials if considered along with the electronic charge. Extensive efforts have been made for the synthesis of nano-size novel DMSs materials that exhibit ferromagnetism at room temperature from III–V and II–VI compound semiconductors. However, TM doped II–VI semiconductor compounds are getting attention as TM semiconductors based on III–V encounter lack of solubility issue.[8,9] Among the wide band gap II–VI binary semiconductors, CdS is an important direct-band semiconductor with a band gap of 2.42 eV and is broadly used in optoelectronics such as solar cells, LEDs, flat panel displays, thin film transistors and laser cooling.[10–16] As we know that Fe is a good ferromagnetic material with low coercivity and high Curie temperature,[17] and Fe(III) have five *d* electrons, therefore has attracted lot of attention for synthesizing DMSs in III–V and II–VI semiconductors for several decades.[18,19] In the past, it has been introduced intentionally into semiconductor materials to achieve semi-insulating materials.[20] Therefore, Fe based CdS nanomaterials can lead to a number of possible applications such as magneto-optic device, magnetic sensors and so on. Fe ions doping or codoping in CdS nanostructures (thin films, nanocrystals, quantum dots and quantum rods)[17,21–25] have been accomplished through various methods. Their magnetic properties of the incorporated Fe ions have been

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THE EUROPEAN PHYSICAL JOURNAL PLUS

Regular Article

Interaction of magnetic field with heat and mass transfer in free convection flow of a Walters'-B fluid

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Abstract. The heat and mass transfer phenomenon is studied in the unsteady free convection flow of a Walters'-B fluid in the presence of a transverse magnetic field. The problem is modelled in terms of partial differential equations with some physical conditions. Exact solutions for velocity, temperature and concentration are obtained via Laplace transform method. They satisfy imposed initial and boundary conditions. As a special case for $\Gamma \to 0$, these solutions can be be reduced to the similar solutions for Newtonian fluids. The shear stress at the boundary is evaluated from the velocity solution. Numerical results of velocity and shear stress are portrayed through graphs and discussed for various embedded parameters.

1 Introduction

Researchers have proved that the Newtonian fluid model is adequate only for gases (air) and small molecules liquids such as water, ethanol and benzene. High-molecular-weight liquids which include polymer solutions and molten polymer, as well as liquids in which fine particles are suspended (slurries and pastes), for example, polymer solutions and molten polymers are quite important in industry, but unfortunately the Newtonian fluid model cannot be used to describe them. That is they may exhibit dynamic devitiation from Newtonian behavior depending upon the flow configuration or the rate of deformation. Such fluids are known as non-Newtonian fluids, and the subject of rheology is devoted to the study of the behavior of such fluids [1]. Examples of non-Newtonian fluids are ketchup, food, slurries, custard, starch suspension, toothpaste, shampoo, paint, glues, printing inks, and blood. It is important to mention here that a fluid not only depends on its chemical structure but also on the flow condition. Therefore, the same fluid can behave as Newtonian or non-Newtonian such as blood. Hence, the rheological properties of non-Newtonian fluids unlike Newtonian fluids cannot be described by a single constitutive equation. These fluids often obey non-linear constitutive equations and the complexity of their constitutive equations is the main culprit for the lack of exact analytical solutions. Due to this reason, several models or constitutive equations for non-Newtonian fluids have been proposed in the literature. Despite of this fact, no accurate model is available for large numbers of fluids under different flow conditions. Therefore, recently non-Newtonian fluid dynamic has become one of the hot topic of current research and researchers from different areas are making their valuable contributions, developing new models and solution techniques (analytical or numerical) to understand the physics of the non-Newtonian fluids [2–10]. Amongst them, most of the researchers are using existing models and modify them accordingly, to address the real world problems important in engineering and industry. One of the physical phenomena where the fluid models particularly non-Newtonian models are extensively studied in the past few decades is the combined phenomenon of heat and mass transfer [11–17]. Therefore, the present paper investigates the combined phenomena of heat and mass transfer over a vertical plate with applied magnetic field acting in a transverse direction to the plane of the plate. Amongst the different non-Newtonian fluids, we have chosen Walters'-B fluid for the present work. Because significance of the results reported in the above works is limited as for as the polymer industry is concerned. This model was introduced by Walters in 1960 [18]. Walters model is recently quite famous as the scientists believe that it can accurately simulate the complex flow behavior

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Journal of Applied Polymer Science

Carbonized electrospun polyacrylonitrile nanofibers as highly sensitive sensors in structural health monitoring of composite structures

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ABSTRACT: Electrospun polyacrylonitrile (PAN) nanofibers were stabilized at 280°C for 1 h in an ambient condition, and then carbonized at 850°C in inert argon gas for additional 1 h in order to fabricate highly pure carbonous nanofibers for the development of highly sensitive sensors in structural health monitoring (SHM) of composite aircraft and wind turbines. This study manifests the real-time strain response of the carbonized PAN nanofibers under various tensile loadings. The prepared carbon nanofibers were placed on top of the carbon fiber pre-preg composite as a single layer. Using a hand lay-up method, and then co-cured with the pre-preg composites in a vacuum oven following the curing cycle of the composite. The electric wires were connected to the top surface of the composite panels where the cohesively bonded conductive nanofibers were placed prior to the tensile and compression loadings in the grips of the tensile unit. The test results clearly showed that the carbonized electrospun PAN nanofibers on the carbon fiber composites were remarkably performed well. Even the small strain rates (e.g., 0.020% strain) on the composite panels were easily detected through voltage and resistance changes of the panels. The change in voltage can be mainly attributed to the breakage/deformation of the conductive network of the carbonized PAN nanofibers under the loadings. The primary goal of the present study is to develop a cost-effective, lightweight, and flexible strain sensor for the SHM of composite aircraft and wind turbines. © 2015 Wiley Periodicals, Inc. J. Appl. Polym. Sci. **2016**, *133*, 43235.

KEYWORDS: composites; conducting polymers; electrospinning; fibers; mechanical properties

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INTRODUCTION

Structural health monitoring (SHM) is a method of implementing a damage identification strategy for all kinds of infrastructures such as bridges, tunnels, aircrafts, wind turbines, ships, skyscrapers, and towers in order to examine the prevailing health conditions in real-time and provide an approximate estimation of the remaining service life of the structures.[1–3] SHM allows engineers to use the sensing of the structural responses against all types of external and internal loadings during the service in accordance with proper data acquisition and model updating techniques to appraise the condition of a structure. The purpose of SHM is to effectively monitor the damages in infrastructures in real-time by embedding a nondestructive evaluation system (NDE) system into the structure and take preventive measures before a catastrophic failure.[4] A traditional inspection system is costly and time consuming. The SHM system is less time consuming and prevents failure during operation. The prospective advantages of SHM are enormous, since the maintenance procedures for structures can change from schedule-based to condition-based, resulting in cutting down on the period for which structure is out of service and corresponding cost savings, as well as reduction in labor requirements.

Composite materials present more challenges in inspection due to the presence of voids, anisotropy, resin-rich regions, fiber pull-outs, and delamination. Composite materials generally fail as a result of an interacting damage mode and damages generally occur beneath the top surface of ply. Strain sensors are extensively used in many engineering fields for monitoring and damage detection in infrastructures.[5] Conventional strain gauges are limited by the necessary requirements of the strain gauge to be able to measure strain in a specific direction, and they possess limited sensitivity.[5] The demand for new materials for sensors is on rise, and use of the carbon-based materials for sensors holds the promise of fulfilling the drawbacks that conventional sensors present, owing to their superior mechanical and electrical properties.[6,7] Recently, there has been a major interest in using polymer nanocomposites as strain sensors due to their outstanding properties.[8]

Carbon nanofibers possess excellent thermal and electrical properties; have wide range of applications, such as structural components,

PLOS | ONE

RESEARCH ARTICLE

Human Milk Cells and Lipids Conserve Numerous Known and Novel miRNAs, Some of Which Are Differentially Expressed during Lactation

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Data Availability Statement: All raw small RNA sequences are available in the NCBI Gene Expression Omnibus database under accession number GSE75726. Additional information is also included as supplementary files within the paper.

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Abstract

Human milk (HM) is rich in miRNAs, which are thought to contribute to infant protection and development. We used deep sequencing to profile miRNAs in the cell and lipid fractions of HM obtained post-feeding from 10 lactating women in months 2, 4, and 6 postpartum. In both HM fractions, 1,195 mature known miRNAs were identified, which were positively associated with the cell ($p = 0.048$) and lipid ($p = 0.010$) content of HM. An additional 5,167 novel miRNA species were predicted, of which 235 were high-confidence miRNAs. HM cells contained more known miRNAs than HM lipids (1,136 and 835 respectively, $p<0.001$). Although the profile of the novel miRNAs was very different between cells and lipids, with the majority conserved in the cell fraction and being mother-specific, 2/3 of the known miRNAs common between cells and lipids were similarly expressed ($p>0.05$). Great similarities between the two HM fractions were also found in the profile of the top 20 known miRNAs. These were largely similar also between the three lactation stages examined, as were the total miRNA concentration, and the number and expression of the known miRNAs common between cells and lipids ($p>0.05$). Yet, approximately a third of all known miRNAs were differentially expressed during the first 6 months of lactation ($p<0.05$), with more pronounced miRNA upregulation seen in month 4. These findings indicate that although the total miRNA concentration of HM cells and lipids provided to the infant does not change in first 6 months of lactation, the miRNA composition is altered, particularly in month 4 compared to months 2 and 6. This may reflect the remodeling of the gland in response to infant feeding patterns, which usually change after exclusive breastfeeding, suggesting adaptation to the infant's needs.

SCIENTIFIC REPORTS

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Interaction driven quantum Hall effect in artificially stacked graphene bilayers

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The honeycomb lattice structure of graphene gives rise to its exceptional electronic properties of linear dispersion relation and its chiral nature of charge carriers. The exceptional electronic properties of graphene stem from linear dispersion relation and chiral nature of charge carries, originating from its honeycomb lattice structure. Here, we address the quantum Hall effect in artificially stacked graphene bilayers and single layer graphene grown by chemical vapor deposition. The quantum Hall plateaus started to appear more than 3T and became clearer at higher magnetic fields up to 9T. Shubnikov-de Hass oscillations were manifestly observed in graphene bilayers texture. These unusual plateaus may have been due to the layers interaction in artificially stacked graphene bilayers. Our study initiates the understanding of interactions between artificially stacked graphene layers.

The robust electronic properties of graphene stem from linear dispersion relation, containing massless Dirac fermions and chiral nature of charge carriers. This behavior of graphene originats from its honeycomb lattice structure. Bernal stacked bilayers graphene consists of massive Dirac fermions spectrum, which is demonstrated by two pairs of parabolic bands[1–3]. The massless Dirac spectrum could be expectedly present in bilayers graphene if both layers were precisely placed with AA-stacking symmetry[4,5]. The staking of more graphene layers are useful for vertical transport which enhance the spin signal[6,7]. The structural distortion in the layers is manifested to the formation of correlated states and therefore the distortion can be created by applying strain[8,9], as stacking one layer on top of another layer[10–15]. This artificial stacking of graphene bilayers is usually expected to be unstable towards symmetry breaking due to the twist angle. The recent reports showed that a very small distribution is sufficient enough to generate a completely new electronic spectrum with broken symmetry[16]. The interlayer Coulomb interactions and tunneling effects of the two closely spaced graphene layers may lead to a new interesting phenomena. The new phenomenon is similar to the bilayers of two dimensional electron gas; which not present in individual layers[17–19]. Perhaps due to the Fermi surface of carbon it is possible where the honeycomb lattice in graphene are centered at nonzero K vectors[20] and relative disparity between the layers resulting in weak coupling[21]. The effect of symmetry breaking of graphene and its significant in electronic transport properties is an enduring topic to identify the various ground states.

The electrical transport such as quantum Hall effect in single and Bernal stacked bilayers graphene has been explored to a large extent. However, it is interesting to investigate the electronic transport properties of artificially stacked graphene layers. Here we report the electronic transport properties of artificially stacked chemical vapor deposition grown graphene bilayers. We have observed that the quantum Hall effect consisting of various plateaus with non-integer quantized values at 4.2 K, however a typical massless Dirac fermions spectrum has observed in a single layer graphene. The clear quantum Hall plateaus started to appear from 3 T in graphene bilayers and became more prominent at higher magnetic fields. The Shubnikov-de Hass (SdH) oscillations were observed as well in graphene bilayers texture.

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Non-aligned MHD stagnation point flow of variable viscosity nanofluids past a stretching sheet with radiative heat

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ABSTRACT

This paper investigates the problem of oblique hydromagnetic stagnation point flow of a variable viscosity electrically conducting optically dense viscous incompressible nanofluid over a convectively heated stretching sheet in the presence of thermal radiation. The nanofluid model employed in this study incorporates the effects of Brownian motion and thermophoresis. The governing nonlinear partial differential equations for momentum, energy and nanoparticles concentration are reduced into a set of non-linear ordinary differential equations with the aid of suitable similarity transformations. The transformed equations are numerically integrated using fourth–fifth order Runge–Kutta–Fehlberg method. The effects of various controlling parameters on the dimensionless velocity, temperature, nanoparticles concentration, skin friction, Nusselt and Sherwood numbers are analysed and presented graphically. Obtained numerical results are compared and found to be in good agreement with previously published results as special cases of the present investigation. It is found that non-alignment of the re-attachment point on the sheet surface decreases with an increase in magnetic field intensity.

1. Introduction

The study of stagnation point flow and heat transfer over a stretching surface has attracted the attention of many researchers due to its wide range of applications in industrial processes and engineering. These applications include rapid spray cooling and quenching in metal foundries, emergency core cooling systems, cooling of microelectronics, and the ice chiller in air-conditioning systems, wire drawing, polymer extrusion, continuous casting of metals, fabrication of adhesive tapes and glass blowing, etc. For instance, spray cooling is an efficient way to remove high heat flux from convectively heated sheet surfaces. The performance of spray cooling usually depends on a number of factors; such as the working fluid dynamics, heated surface condition, nozzle type, nozzle-to-surface distance, etc. [1]. Moreover, the application of nanofluids in spray cooling for industrial and engineering devices is an emerging area of research [2]. Nanofluids are fluids that contain nanoparticles, such as metals, oxides, carbides, and nitrides, with sizes less than 100 nm and are known to serve as better coolant due to their higher thermal conductivity compared to that of the conventional base fluid, such as water, engine oil, and ethylene [3]. The stagnation point flows may be oblique, orthogonal or axisymmetric. Detail description of oblique stagnation-point flows and its applications can be found in the textbook by Drazin and Riley [4]. Steady two-dimensional oblique stagnation point flow of different fluids on a stretching surface has been studied by a number of researchers. Reza and Gupta [5] analysed oblique stagnation-point flow of an incompressible viscous fluid towards a stretching surface. They found that the thickness of the boundary layer decreases with an increase in straining motion near the stagnation region. Mahapatra et al. [6] extended their studies to radiative heat transfer of an incompressible viscous fluid towards a shrinking. They showed that multiple solutions exist for a certain range of the ratio of the shrinking velocity to the free stream velocity. Later on, Nadeem et al. [7] numerically studied non-orthogonal stagnation point flow of a nano non-Newtonian fluid toward a stretching surface. They found that heat transfer decreases with an increase in Brownian motion and thermophoresis parameters. Attia [8] analysed hydromagnetic laminar three dimensional axisymmetric stagnation point flow of an incompressible viscous fluid impinging on a permeable stretching surface with heat generation or absorption. It was found that increasing the stretching velocity increases the velocity components but decreases the velocity boundary layer thickness. Zhu et al. [9] investigated the stagnation point of axisymmetric flow towards a stretching sheet

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Oral and Maxillofacial Surgery/Review article

Simvastatin, dosage and delivery system for supporting bone regeneration, an update review

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ABSTRACT

Objective: The purpose of this review is to discuss the dosage, duration and carrier for simvastatin, and to summarize effects of topical application directly or indirectly for stimulating bone regeneration.
Methods: We have searched in Pubmed using keywords, simvastatin, dose response, bone regeneration, controlled-release delivery system. This search was complemented with a manual search of the relevant articles cited among the selected papers. The search was among the articles written in English and published in the last 10 years. The articles were revised in depth, and summarized.
Results: High dose of simvastatin increases bone formation and resorption, while low dose of simvastatin decreases bone formation and increases bone resorption, furthermore it is reported that high dose of systemic administration of simvastatin will raise the risk of liver failure, kidney disease, and other side effects. Local administration can bypass hepatic degradation of statins to achieve therapeutic concentrations in bone and avoid the systemic side effects. The choice of appropriate carrier will depend on the release kinetics determined to be the best for osteogenesis.
Conclusion: Local delivery of simvastatin from carriers appears to be an attractive solution to the problem of maintaining therapeutic doses to treat severe bone defects and to minimize the undesired side effects. Locally delivered simvastatin can increase the bone formation and accelerate healing process of bony defect. Another advantage of local delivery system is that it can stimulate new bone formation in a dose-dependent manner. Further evidence-based studies will be required to determine local delivery concentrations to promote bone regeneration.

Contents

☆ Asian AOMS: Asian Association of Oral and Maxillofacial Surgeons; ASOMP: Asian Society of Oral and Maxillofacial Pathology; JSOP: Japanese Society of Oral Pathology; JSOMS: Japanese Society of Oral and Maxillofacial Surgeons; JSOM: Japanese Society of Oral Medicine; JAMI: Japanese Academy of Maxillofacial Implants.

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BIOMECHANICAL EFFECT OF TESTING POSITIONS ON HAND GRIP STRENGTH

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Hand grip strength (HGS) is a useful functional measure of the integrity of the upper extremities, however, many studies have examined it from selected positions (i.e., supine, sitting, standing), with no emphasis on other derived positions that are used in clinical setting. This study's objective was to evaluate HGS in different body positions that are used in clinical setting by using a standard protocol. The study sample was a convenience sample of 40 healthy male participants with no history of psychiatric, neurological, or upper extremity orthopedic dysfunction. Grip strength in the dominant hand was measured with a Jamar Plus+ digital hand dynamometer in five positions: Supine, prone, side-lying, sitting, and standing. The HGS value in prone position was significantly lower than in standing position ($p = 0.043$) and sitting position ($p = 0.013$). However, no statistically significant difference was found in HGS among the supine, prone, and side-lying positions. Grip strength was moderately correlated with age ($r = 0.643$). This study provides useful evaluation for grip strength in different positions. In identical upper extremity positions, grip strength varies between different body positions. Grip strength is equivalent when tested from the supine, side-lying, or prone positions, thus the position can be adjusted according to the patient's condition. Finally, age is an important determinant of hand grip evaluation, particularly when standing position is used.

Keywords: Digital hand dynamometer; grip strength; body positions.

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Nuclear spin of odd-odd α emitters based on the behavior of α-particle preformation probability

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The preformation probabilities of an α cluster inside radioactive parent nuclei for both odd-even and odd-odd nuclei are investigated. The calculations cover the isotopic chains from Ir to Ac in the mass regions $166 \leqslant A \leqslant 215$ and $77 \leqslant Z \leqslant 89$. The calculations are employed in the framework of the density-dependent cluster model. A realistic density-dependent nucleon-nucleon (NN) interaction with a finite-range exchange part is used to calculate the microscopic α-nucleus potential in the well-established double-folding model. The main effect of antisymmetrization under exchange of nucleons between the α and daughter nuclei has been included in the folding model through the finite-range exchange part of the NN interaction. The calculated potential is then implemented to find both the assault frequency and the penetration probability of the α particle by means of the Wentzel-Kramers-Brillouin approximation in combination with the Bohr-Sommerfeld quantization condition. The correlation of the α-particle preformation probability and the neutron and proton level sequences of the parent nucleus as obtained in our previous work is extended to odd-even and odd-odd nuclei to determine the nuclear spin and parities. Two spin coupling rules are used, namely, strong and weak rules to determine the nuclear spin for odd-odd isotopes. This work can be a useful reference for theoretical calculation of undetermined nuclear spin of odd-odd nuclei in the future.

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I. INTRODUCTION

In recent years, the investigation of the α decay of radioactive nuclei has become a very interesting and popular research topic in nuclear physics, as it provides a powerful and useful tool for probing nuclear structure [1–5]. It can provide reliable information on ground-state lifetime, nuclear charge radius, nuclear incompressibility, nuclear spin, parity, and the collective excitations of the involved nuclei [6–11]. Moreover, the α decay plays a key role in the recent exploration of the island of stability of the newly synthesized superheavy nuclei [12–15].

The α-decay process is treated conventionally as the tunneling process of the preformed α particle through an interaction potential barrier between the cluster and core nucleus [16]. The α-decay half-life of the radioactive nucleus is completely determined by the decay width. In the cluster model, the decay width is well described as a product of three model-dependent quantities, namely, the barrier penetration probability which can be obtained in terms of the well-known Wentzel-Kramers-Brillouin (WKB) semiclassical approximation, the assault frequency, and the preformation probability of the emitted clusters inside the decaying nucleus.

An interesting aspect in α decay is how to estimate the α preformation probability, which gives the probability that the α particle exists as a recognizable entity inside the nucleus before its emission [17]. The determination of the exact value of the preformation factor is essential for improving the accuracy of theoretical calculations. It would help in estimating the half-lives of the superheavy elements which affect their survival probability against different decay channels. On the other hand, this preformation factor is considered to carry most of the valuable information about nuclear structure, especially about the dynamic states of nucleons around the nuclear surface[18]. It is expected to reflect the influences of the different nuclear structure properties of the parent and its decay components, such as their isospin asymmetry[19], shell and pairing effects [20], and their deformations [21–23]. It was revealed in our recent studies [24–26] that the behavior of the preformation factor is associated with the neutron and proton level sequences of the parent nucleus, and can be used to predict the nuclear spin for both even-even and even-odd nuclei. Moreover, it was pointed out that the existence of unpaired nucleons in the open shells of the parent nucleus influences the preformation mechanism [27]. The α-cluster preformation probability inside the nuclei that have unpaired nucleons is less than it would be in the neighboring nuclei of the same shell and subshell closures but have no unpaired nucleons [27].

In principle, the preformation factor can be calculated from the overlap between the actual wave function of the parent nucleus and the wave function of the decaying state describing the α particle coupled to the residual daughter nucleus [28,29]. In these calculations, the wave function is necessary, and it is not easy to include very large basis and massive configuration mixing to access the actual wave function, which becomes even more sophisticated when more nucleons relevant to the preformation are considered. Several factors may affect the calculated values of the α-preformation probability from different theoretical approaches such that the deformation of the involved nuclei, the isospin asymmetry, and the angular momentum transfer in case of involved nuclei include odd nucleon numbers. It should be noted that the extracted α-preformation factors are different for various models; that is, they are model-dependent factors [30–33]. More strikingly, the varying trend of the preformation factor, such as for an isotopic chain, is model independent [34].

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Photodynamic Effect of NiO in HepG2 Cellular Model

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Abstract

Nanomaterials are basic tool in ongoing research having tremendous clinical, antitumorcal, microbial, non microbial applications. Due to their unique properties such as high quantum yield, smaller size and tunable emission wavelength over wide spectrum of light, they are front runners Nano-dependent PDT technique involving nanoparticles (NPs) is simple, biologically safe, biocompatible in absence of UV light, increases endogenous fluorescence, noninvasive, fast with their least permeability in normal cells. But nickel oxide nanoparticles (NiO NPs) having large surface to volume ratio shows maximum toxicity. Hence they could be utilized as an efficient photosensitizer by providing intrinsic white light leads to the necrosis effect. The main focus of our research is to improve the effectiveness of PDT by using malignant cell line as biological model. In present experiment, NiO NPs were synthesized by using precipitation technique. After successful growth of mentioned NPs, characterization step had been performed. In the last step, toxicity of NiO will be tested in hepatocellular model (HepG2 cell line). Our main objective was to determine the actual cell killing effects (via apoptosis and necrosis) and relevant parameters relationship with loss in cell viability using HepG2 as an experimental biological model. After successful investigation of Biotoxicity of HepG2 cellular model the author will be able to quote the protocol for real treatment of liver cancer patients.

Keywords:NiO Nanoparticles; Photodynamic Therapy (PDT); Human Hepatocellular (HepG2 Cell Line) Model; Biotoxicity

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Synthesis, characterization and amoebicidal potential of locally synthesized TiO_2 nanoparticles against pathogenic *Acanthamoeba* trophozoites in vitro

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ABSTRACT

Acanthamoeba is an opportunistic protozoan pathogen that plays a pivotal role in the ecosystem. It may cause blinding keratitis and fatal encephalitis involving the central nervous system. Here we synthesized pure and Zn doped TiO_2 nanoparticles (~10–30 nm) via sol–gel and sol–hydrothermal methods and demonstrated its impact on the biological characteristics of pathogenic *Acanthamoeba castellanii*. Our results revealed that pure and Zn doped TiO_2 nanoparticles synthesized by sol–hydrothermal methods (ranging 5, 10, 25 and 50 μg/ml) exhibited amoebicidal effects i.e., >60% of trophozoites executed under normal light at maximum dose (50 μg/ml) within 1 h incubation. In contrast pure/doped TiO_2 obtained via sol gel method showed ~40% amoeba damage. Furthermore, amoebae growth assay demonstrated that Zn doped TiO_2 also inhibited *Acanthamoeba* numbers up to 7 days in dose dependent manner. It was interesting to note that all the tested TiO_2 nanoparticles have shown maximum amoebicidal effects at pH 7 which is quite relevant to amoebic growth favorable conditions. Our results confirmed that TiO_2 has inhibitory effects on *Acanthamoeba* growth and viability. Overall, we reported the amoebicidal and amoebic growth inhibition potential of pure and Zn doped TiO_2 nanoparticles against *Acanthamoeba* due to attached OH^- groups, reduced size and decreased band gap of sol hydrothermally synthesized TiO_2 nanoparticles.

1. Introduction

Acanthamoeba is an opportunistic protozoan pathogen and recognized to cause serious human infections including i) chronic granulomatous encephalitis in immunocompromised individuals (involving the central nervous system which always results into death, ii) painful keratitis (an infection of the eye resulting in blindness) mostly related to contact lens wearers [1–3], and iii) disseminated infections including the skin, sinuses, lungs, prostate, and uterus [4]. Treatment of *Acanthamoeba* infections is always very difficult and not effective. Although a number of antimicrobials have been used in the past to treat *Acanthamoeba* infections but no drug has been found to be useful. A few patients have been recovered after a combination of multiple drugs, but the outlook for most patients remains hopeless especially because of HIV/AIDS and other opportunistic infections [5,6]. Recently, however, several patients recovered after treatment with a combination of drugs commenced at an early stage of the disease [7–9]. However, in the later stages of the disease, the majority of therapeutic agents are ineffective [10–13]. Therefore, it is important to develop more active and dynamic therapies that facilitate the continuance of the treatment by the patients.

Due to the emergence and increase in microbial resistance to multiple antibiotics, and the ongoing emphasis on health-care costs, many researchers have tried to develop new, effective antimicrobial reagents free of resistance and cost. Reducing the particle size of materials is an efficient and reliable tool for improving their biocompatibility. In fact, nanotechnology helps in overcoming the limitations of size and can change the outlook of the world regarding science [14]. Furthermore, nanomaterials can be modified for better efficiency to facilitate their applications in different fields such as bioscience and medicine. Metal oxide nanoparticles such as TiO_2, CuO, ZnO, and AgO, are frequently studied for their antibacterial effects based on their capability to generate reactive oxygen species in their water suspensions following UV light absorption [15]. In this context, the investigation of TiO_2 nanoparticles is a new emerging strategy for finding alternative treatment. Furthermore the ability of TiO_2 to control microbial infections has been investigated by Japanese researchers. For examples, TiO_2 is added to the hospital garments to control hospital infections such as methicillin

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Chronic effects of soft drink consumption on the health state of Wistar rats: A biochemical, genetic and histopathological study

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Abstract. The present study was performed to examine the effects of chronic soft drink consumption (SDC) on oxidative stress, biochemical alterations, gene biomarkers and histopathology of bone, liver and kidney. Free drinking water of adult male Wistar rats was substituted with three different soft drinks: Coca-Cola, Pepsi and 7-Up, for three consecutive months. The serum and organs were collected for examining the biochemical parameters associated with bone, liver and kidney functions. Semi-quantitative reverse transcription polymerase chain reaction was used to observe the changes in the expression of genes in the liver and kidney, which are associated with oxidative stress resistance. Histopathological investigations were performed to determine the changes in bone, liver and kidney tissues using hematoxylin and eosin stains. SDC affected liver, kidney and bone function biomarkers. Soft drinks increased oxidative stress, which is represented by an increase in malondialdehyde and a decrease in antioxidant levels. SDC affected serum mineral levels, particularly calcium and phosphorus. Soft drinks downregulated the expression levels of glutathione-S-transferase and super oxide dismutase in the liver compared with that of control rats. Rats administered Coca-Cola exhibited a hepatic decrease in the mRNA expression of α2-macroglobulin compared with rats administered Pepsi and 7-Up. On the other hand, SDC increased the mRNA expression of α1-acid glycoprotein. The present renal studies revealed that Coca-Cola increased the mRNA expression levels of desmin, angiotensinogen and angiotensinogen receptor compared with the other groups, together with mild congestion in renal histopathology. Deleterious histopathological changes were reported predominantly in the bone and liver of the Coca-Cola and Pepsi groups. In conclusion, a very strict caution must be considered with SDC due to the increase in oxidative stress biomarkers and disruption in the expression of certain genes associated with the bio-vital function of both the liver and kidney.

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Key words: soft drinks, chronic consumption, health state, molecular effects, histopathology

Introduction

Soft drinks consumption (SDC) has increased worldwide in the past two-three decades (1). Their effects on health are unclear, although epidemiological studies pointed toward its associations with obesity, kidney, liver diseases and osteoporosis (2,3). Soft drinks contain predominantly water, phosphoric acid, caffeine, sugar in the form of sucrose and other chemicals in the form of preservatives, colorings and flavors (2). The rate of SDC is alarming, particularly in the affluent countries (4). Numerous various health problems are associated with regular consumption of soft drinks (2). It has been shown that ~25 separate harmful effects are associated with SDC (2,3). Contents of soft drinks have a bad effect on human health (4). Caffeine in carbonated beverages is deliberately added to make individuals addicted , and is readily absorbed rapidly compared with any other drink (5).

A correlation exists between SDC and the incidence of multiple diseases, including obesity, dental/bone problems, diabetes mellitus and cardiovascular disease (6-9). Additionally, SDC is notbaly associated with kidney health and a high risk of kidney stone formation (10,11). SDC causes bone fracture, disruption in bone formation, affects serum or urinary calcium metabolism markers and hypocalcemia, both in clinical and experimental settings (4,12-16). However, no significant association between SDC and the

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Fabrication and Applications of Potentiometric Sensors Based on *p-tert*-butylthiacalix[4]arene Comprising Two Triazole Rings Ionophore for Silver Ion Detection

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This work describes the fabrication and applications of potentiometric silver-selective sensors, based on the use of a newly synthesized *p-tert*-butylthiacalix[4]arene comprising two triazole rings, as a novel neutral ionophore in plasticized poly(vinyl chloride) (PVC) membranes. The effect of lipophilic anionic additives on the voltammetric responses of the sensors was investigated in details. The constructed sensors exhibited a Nernstian behavior with 53 ± 0.9 mV per decade change in Ag^+ activity over the range from $7.0x10^{-6}$ to $8.0x10^{-3}$, with a repetitive detection limit of 0.421 µg mL^{-1}. Moreover, the effect of lipophilic salts, plasticizers and various interfering ions were probed. Importantly, validation of the method is achieved in terms of good performance characteristics, including good selectivity for Ag^+ over alkali, alkaline earth and transition metal ions (e.g. Na^+, K^+, Pb^{2+}, Mg^{2+}, Co^{2+} Ni^{2+}, and Cu^{2+}) together with long life span. Other important characteristics such as low detection limit, acceptable accuracy and precision, long term stability, reproducibility were also demonstrated. On the application side, the sensors were utilized for facile potentiometric measurements of iodide ions (I^-) over the concentration range of 0.749 to 856 µg mL^{-1} and also employed for probing sequential titration of some importantly relevant anions (e.g. Cl^-, Br^-, I^-, SCN^- and N^{-3}). Significantly, sequential binding of these anions with Ag^+ cations produces sharp stepwise titration curves with consecutive end point breaks at the equivalent points.

Keywords: Thiacalix[4]arenes; silver-ion selective electrode ; Potentiometry.

1. INTRODUCTION

The determination of silver in environmental, industrial and waste samples is of considerable interest in analytical chemistry [1]. To date, the most commonly used techniques for silver ion

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Human Milk Cells Contain Numerous miRNAs that May Change with Milk Removal and Regulate Multiple Physiological Processes

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Abstract: Human milk (HM) is a complex biofluid conferring nutritional, protective and developmental components for optimal infant growth. Amongst these are maternal cells, which change in response to feeding and were recently shown to be a rich source of miRNAs. We used next generation sequencing to characterize the cellular miRNA profile of HM collected before and after feeding. HM cells conserved higher miRNA content than the lipid and skim HM fractions or other body fluids, in accordance with previous studies. In total, 1467 known mature and 1996 novel miRNAs were identified, with 89 high-confidence novel miRNAs. HM cell content was higher post-feeding ($p < 0.05$), and was positively associated with total miRNA content ($p = 0.014$) and species number ($p < 0.001$). This coincided with upregulation of 29 known and 2 novel miRNAs, and downregulation of 4 known and 1 novel miRNAs post-feeding, but no statistically significant change in expression was found for the remaining miRNAs. These findings suggest that feeding may influence the miRNA content of HM cells. The most highly and differentially expressed miRNAs were key regulators of milk components, with potential diagnostic value in lactation performance. They are also involved in the control of body fluid balance, thirst, appetite, immune response, and development, implicating their functional significance for the infant.

Keywords: human milk; breastmilk; miRNA profiling; milk cells; next generation sequencing; milk removal; breastfeeding

1. Introduction

Human milk (HM) is a complex system of nutritional and bioactive components that together offer the essential building blocks for the optimal growth, development and protection of the infant [1,2]. The latest research has shifted focus from the nutritional components of HM, which have been well studied, to its bioactive elements, including maternal cells and the molecules they synthesize and secrete, such as microRNAs (miRNAs) [3–5]. The maternal cells of HM are primarily of mammary epithelial origin when the mother and infant are healthy, but they are dominated by immune cells originating from the maternal circulation in the first days postpartum (colostrum) and during periods of infection of either the mother or the infant [4,6,7]. miRNAs are small non-coding RNA molecules (~22 nucleotides long) [8–11] that are present in all three fractions of HM (cells, lipids and skim milk) [8,9,11,12], and have been shown to originate mainly from mammary epithelial cells [12]. They are potent regulators of gene expression at the post-transcriptional level [13] and are involved in several biological processes including apoptosis, cell differentiation, development and growth of

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ORIGINAL ARTICLE

Two parameter scaling group for unsteady convective magnetohydrodynamic flow

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KEYWORDS

Convective heat and mass transfer;
Two parameter scaling group;
MHD flow

Abstract A mathematical model for two dimensional unsteady magneto-convective flows with heat and mass transfer in the presence of a time dependent magnetic field is presented. The system of partial differential equations governing the transport problem is converted to a system of ordinary differential equations via two parameter scaling group transformations, before being solved using an implicit finite difference method. Computed results for non-dimensional velocity, temperature and concentration distributions as well as skin friction factor, local Nusselt number and Sherwood number are discussed for various values of the controlling parameters (Prandtl number, Schmidt number, Richardson number, magnetic field and buoyancy ratio). It is found that the magnetic field causes an increase in the rate of the heat and mass transfers. The buoyancy ratio increases the heat transfer rates and decreases the mass transfer rates.

1. Introduction

Group analysis is a powerful and systematic method to generate invariant transformations of a system of partial differential equations together with the relevant boundary conditions. It reduces the number of independent variables of the partial differential equations under consideration and keeps the system and associated initial and boundary conditions invariant. With the application of this method we can develop similarity transformations. This method has been extensively applied by various researchers in various engineering fields including transport problems. The fundamentals of the application group analysis to differential equations can be found in Ovsiannikov [1], Cantwell [2] and Ibragimov and Kovalev [3]. Representative papers associated with the group analysis of transport phenomena are Afify and Elgazery [4], Hamad et al. [5] and Uddin et al. [6], Mukhopadhyay and Layek [7] and Aziz et al. [8]. All of the aforementioned authors applied one parameter scaling group transformations. However, the process should be repeated "$(n-1)$" times if the original system contains "n" number of independent variables. The simplicity of the method characterizing this technique is then lost. To overcome this difficulty (repetition of the procedure)

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SELECTIVE SYNTHESIS OF MONOSUBSTITUTED *p-tert*-BUTYLTHIACALIX[4]ARENE UNDER PHASE TRANSFER CATALYSIS

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Abstract – Phase transfer catalysis (PTC) technique for lower rim alkylation of *p-tert*-butylthiacalix[4]arene (TCA) with diethyl bromomalonate, phenacyl bromide, *N,N*-diethylchloroacetamide, ethyl bromoacetate and chloroacetonitrile using K_2CO_3, CsOH or Na_2CO_3 as a base and tetraethylammonium bromide (TEAB) as catalyst in benzene has been employed. Selective synthesis of monosubstituted *p-tert*-butylthiacalixarene using K_2CO_3 or CsOH as base has been elaborated. Unprecedented alkylation cyclization as well as arene oxidation by using of Na_2CO_3 as a base for alkylation of *p-tert*-butylthiacalix[4]arene under PTC conditions led to the synthesis of two new *p-tert*-butylthiacalix[4]arene derivatives with heterocyclic bridging rings. The structures of the newly synthesized compounds were characterized by different spectroscopy methods IR, ^{1}H NMR, ^{13}C NMR, and single crystal X-ray diffraction.

INTRODUCTION

Calixarenes have been found to be an outstanding platform for creating attractive host molecules and have prominent host–guest recognition ability towards different ions.[1-3] In 1997, *p-tert*-butylthiacalix[4]arene has been reported by Miyano et al.[4] as a calixarenes analogy with some additional features because of sulfur bridging atom in its skeleton structure attracted much attention in research rather than the classical calixarenes. Thiacalixarenes recognition ability as well as their selectivity alkylation has been improved by the introduction of new functional groups at its active sites upper, lower rims and bridges groups.[5] The lower rim of *p-tert*-butylthiacalix[4]arene which contains four hydroxyl groups are considered the most important active sites for introduction of new functional groups. The mono, di, tri or tetra-alkylated derivatives are all the possible products prepared by alkylation of *p-tert*-butylthiacalixarene at the lower rim

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Monitoring of impact of hooked ends on mechanical behavior of steel fiber in concrete

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HIGHLIGHTS

- The efficiency of Steel Fiber Reinforced Concrete (SFRC) is mainly related to the ability of the fiber and the concrete to work together homogeneously as hardened member.
- The homogeneous work SFRC components after hardening might be obtained through sufficient bond between the fiber and the concrete matrix at its contact points on the interface surfaces.
- If a smooth and straight steel fiber is embedded in concrete matrix and subjected to tensile force, only weak bond may obtain at the interface between the fiber and the concrete.
- If a single smooth and straight steel fiber is embedded in concrete matrix and subjected to tensile force, the bond strength decreases gradually and the fiber can't develop its yield strength, while debond length increases toward the depth of the concrete along the embedded length until failure occurs in bond strength between the fiber and the concrete.
- The fiber pulls out of concrete by frictional sliding movement when debond length reaches the far end of the fiber in the depth of the concrete.
- Computer simulations of single steel fiber (with hooked ends) embedded in concrete matrix are created and developed using finite element models to monitor the development of stresses in different directions.
- When using the sophisticated form of the fiber (with hooked ends), results showed enhancing in bond strength between the fiber and the concrete without changing in concrete mix properties.

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ABSTRACT

The efficiency of hardened composite of Steel Fiber Reinforced Concrete (SFRC) is mainly related to the ability of its components to work together homogeneously. This homogeneously work of SFRC components might be obtained through sufficient bond between the fiber and the concrete matrix at its contact points on the interface surfaces. Usually, if a smooth and straight steel fiber is embedded in concrete matrix and subjected to tensile force, only weak bond may obtain at the interface between the fiber and the concrete. This weak bond decreases gradually parallel with increasing the value of the applied tensile force in the pull-out test, and the fiber can't develop its yield strength, whereas debond length increases toward the depth of the concrete along the embedded length of the fiber until failure occurs in bond strength between the fiber and the concrete, then the fiber pulls out of the concrete through frictional sliding movement. The fracture mechanism of bond strength between the fiber and the concrete might be observed through pull-out tests. To enhance the bond strength performance of the fiber without change the concrete mix properties, it is necessary to find sophisticated form for the fiber such as end hooks. Monitoring of impact of hooked ends on mechanical behavior of steel fiber in concrete is observed during this research, where various pull-out experiments of single steel fiber in two forms (straight and hooked ends) are set using different values of embedded fiber length in concrete matrix. As well as computer simulations of single steel fiber with hooked ends embedded in concrete matrix are created using finite element model to monitor the development of stresses in different directions. Nonlinear results with contour maps and curves of different types of stresses are also obtained from the computer simulations, and numerical evaluation of the impact of enhancing the steel fiber shape has been done through this research.

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Analytical study for unsteady nanofluid MHD Flow impinging on heated stretching sheet

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ABSTRACT

An analysis is carried out to obtain analytical solution of an unsteady two-dimensional MHD nanofluid flow with heat and mass transfer over a heated surface. The governing partial differential equations are reduced to system of nonlinear ordinary differential equations using suitable transformations. The resulting nonlinear coupled system subject to the boundary conditions is solved using homotopy analysis method (HAM). Graphical and numerical demonstrations of the convergence of the HAM solutions are provided. A detailed study illustrating the influences of the magnetic, unsteady, suction/injection and nanofluid parameters, on the dimensionless velocity, temperature, concentration as well as on the skin friction coefficient, the reduced Nusselt and Sherwood numbers is conducted. It is found out that the flow field is substantially influenced due to unsteadiness, transpiration and magnetic field.

1. Introduction

Magneto-fluid-dynamics analyzes the dynamics of electrically conducting fluids such as plasmas, liquid metals and salt water. The term magnetohydrodynamics (MHD) is a combination of magneto (magnetic field), hydro (liquid) and dynamics (movement of particles). The magnetic field induced current flows in a fluid and creates forces on the fluid. The combination of the Navier-Stokes equations of fluid-mechanics and Maxwell's equations of electromagnetism consequently establishes MHD relations [1,2].

Due to promising potential for heat transfer applications, fluid heating and cooling have received significant importance in different industries such as electronics, power, manufacturing and transportation. Due to practical impact, modern cooling techniques are essential for cooling of high-energy devices. In many cases of natural convection, the conventional fluids such as water, engine oil, ethylene glycol etc. have a low thermal conductivity, which limits the heat transfer capabilities. However, the growing demand of advanced technology with respect to miniaturization of electronic devices requires further improvement of heat transfer from the point of view of point energy saving. To overcome this drawback, there is a need to develop a new heat transfer medium behaving like fluid with higher heat transfer capabilities to increase thermal characteristics which is known as nanofluid. Recently numerous numerical/analytical studies for the improvement of heat transfer of nanofluids have been published [3–14]. An excellent review of nanofluid physics and developments can be found in the review paper by Wang and Mujumdar [15]. Buongiorno [16] reported a complete review of convective transport in nanofluids by considering slip mechanisms which generate a relative velocity between the base fluid and nanoparticles. An overview on convective heat transfer in nanofluids and their applications were investigated experimentally and theoretically by Godson et al. [17].

Thermal radiation plays an important role on the flow and heat transfer in space technology. Radiation effects on convective MHD flow problems are also significant in electrical power generation, astrophysical ground, solar power technology, *re*-entry of space vehicle and other industrial areas. Hayat et al. [18] discussed the effects of thermal radiation on the MHD mixed convection flow over a stretching surface. Ibrahim [19] investigated the effects of mass transfer, radiation, Joule heating, and viscous dissipation on steady MHD Marangoni convection flow over a flat surface with suction and injection. Thermal radiation effects on mixed convection heat transfer for viscoelastic fluid flow over a porous wedge were reported by Rashidi et al. [20]. Rana and Bhargava [21] provided numerical solution for nanofluid flow over a nonlinear stretching sheet whilst Mabood et al. [22] studied the effect of thermal radiation on Casson fluid flow, heat and mass transfer around a circular cylinder in porous medium. Shateyi and Prakash [23] studied thermal radiation effects on MHD flow and heat transfer of nanofluids over a moving surface. Nanofluid flow and heat transfer characteristics were studied by numerous researchers including [24–26].

In this paper, our main objective is to investigate the unsteady flow of an electrically conducting nanofluid past a heated stretching sheet with thermal radiation. The problem is first modeled and then solved analytically by homotopy analysis method [27–29]. Convergence

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MHD flow of a variable viscosity nanofluid over a radially stretching convective surface with radiative heat

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ABSTRACT

This study investigates the combined effects of thermal radiation, thermophoresis, Brownian motion, magnetic field and variable viscosity on boundary layer flow, heat and mass transfer of an electrically conducting nanofluid over a radially stretching convectively heated surface. The stretching velocity is assumed to vary linearly with the radial distance. Using similarity transformation, the governing nonlinear partial differential equations are reduced to a set of nonlinear ordinary differential equations which are solved numerically by employing shooting method coupled with Runge-Kutta Fehlberg integration technique. Graphical results showing the effects of various pertinent parameters on the dimensionless velocity, temperature, nanoparticle concentration, local skin friction, local Nusselt and local Sherwood numbers are presented and discussed quantitatively. Comparisons with the earlier results have been made and good agreements are found. The present results reveal that the heat transfer rate is reduced with viscosity and nanofluid parameters whereas the mass transfer rates is enhanced with Brownian motion parameter and Lewis number.

1. Introduction

Many engineering and industrial processes involve heat transfer by means of a flowing fluid in either laminar or turbulent regimes. A decrease in thermal resistance of heat transfer in the fluids would significantly benefit many of these applications/processes. It is well known that conventional heat transfer fluids, such as oil, water and ethylene glycol mixture are poor heat transfer fluids due to lower thermal conductivity. Nanofluids have the potential to reduce thermal resistances in many applications such as electronics, medical, food and manufacturing. Nanofluids are dilute suspensions of functionalized nanoparticles with higher thermal conductivity and smaller than 100 nm in diameter. They have been utilized in diverse technologies including turbulent flows [1], bio-fluids and polymer solutions [2,3], drug delivery and food biophysics [4], propellant combustion [5], crystal growth [6] and automotive engine cooling [7]. Makinde and Aziz [8] reported the similarity solutions for the thermal boundary layer of a nanofluid past a stretching sheet with a convective boundary condition, Aziz et al. [9] considered free convection boundary layer flow past a horizontal flat plate embedded in porous medium filled by nanofluid containing gyrotactic microorganisms. Motsumi and Makinde [10] examined the effects of thermal radiation and viscous dissipation on nanofluids flow over a permeable moving flat plate. Alsaedi et al. [11] provided an analysis to discuss the stagnation point flow of nanofluid near a permeable stretched surface with thermal convective condition. Butt and Ali [12] performed entropy analysis of magnetohydrodynamic flow and heat transfer over a convectively heated radially stretching surface.

The sub-branch of nanofluids termed magnetic nanofluids has also shown significant promise in numerous engineering fields. These fluids respond to applied magnetic fields and allow further manipulation of heat transfer and hydrodynamic characteristics. Significant experimental analyses of magnetic nanofluids have been conducted by Parekh and Lee [13]. The tribological performance of magnetic nanofluids has been recently elucidated by Andablo-Reyes et al. [14]. Ellahi [15] studied magnetohydrodynamic (MHD) flow of non-Newtonian nanofluid in a pipe and observed that the MHD parameter decreases the fluid motion and the velocity profile is larger than that of the temperature profile even in the presence of variable viscosities, Rashidi et al. [16] considered the analysis of the second law of thermodynamics applied to an electrically conducting incompressible nanofluid fluid flowing over a porous rotating disc. Sheikholeslami et al. [17] studied the magnetic field effects on CuO–water nanofluid flow and heat transfer in an enclosure which is heated from below. Effects of nanofluid on heat transfer enhancement have been considered by several researchers including [18–25] among others.

In most of the studies, the viscosity of the fluid was assumed to be constant. When the effects of variable viscosity is taken into account, the flow characteristics are significantly changed compared to the constant property case. Hence, main goal of the present work is to conduct a

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Heat transfer analysis in a second grade fluid over and oscillating vertical plate using fractional Caputo–Fabrizio derivatives

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Abstract This paper presents a Caputo–Fabrizio fractional derivatives approach to the thermal analysis of a second grade fluid over an infinite oscillating vertical flat plate. Together with an oscillating boundary motion, the heat transfer is caused by the buoyancy force induced by temperature differences between the plate and the fluid. Closed form solutions of the fluid velocity and temperature are obtained by means of the Laplace transform. The solutions of ordinary second grade and Newtonian fluids corresponding to time derivatives of integer and fractional orders are obtained as particular cases of the present solutions. Numerical computations and graphical illustrations are used in order to study the effects of the Caputo–Fabrizio time-fractional parameter α, the material parameter α_2, and the Prandtl and Grashof numbers on the velocity field. A comparison for time derivative of integer order versus fractional order is shown graphically for both Newtonian and second grade fluids. It is found that fractional fluids (second grade and Newtonian) have highest velocities. This shows that the fractional parameter enhances the fluid flow.

1 Introduction

The concept of fractional-order derivatives is as old as for integer-order derivatives. For the past three decades, this subject was limited only to mathematics. However, in the last few years, the concepts of fractional calculus were frequently applied to other disciplines. Recently, this subject has been extended in various directions such as fractional-order multipoles in electromagnetism, electrochemistry, tracer in fluid flows, model of neurons in biology, finance, signal processing, applied mathematics, bio-engineering, viscoelasticity, fluid mechanics, and fluid dynamics [1]. In fluid dynamics, the fractional derivative models were used widely in the past for the study of viscoelastic materials such as polymers in the glass transition and in the glassy state [2]. Recently, it has increasingly been seen as an efficient tool through which a useful generalization of physical concepts can be obtained. The fractional derivatives used most are the Riemann–Liouville fractional derivative and the Caputo fractional derivative [3,4]. It is well known that these operators exhibit difficulties in applications. For example, the Riemann-Liouville derivative of a constant is not zero and the Laplace transform of the Riemann–Liouville derivative contains terms without physical signification. The Caputo fractional derivative has eliminated these difficulties, but the kernel of the definition is a singular function. Caputo and Fabrizio have introduced recently a new definition of the fractional derivatives with an exponential kernel without singularities [5]. The Caputo–Fabrizio temporal-fractional derivative is suitable in the use of the Laplace transform. The spatial representation of the Caputo–Fabrizio derivative is adequate in the use of the Fourier transform. Due to increased interest in modeling with the help of the fractional derivative, several existing fluid models are generalized and fractional derivatives models have been developed. Amongst them, the most popular fluid models are fractional second grade model, the fractional Maxwell model, the fractional Oldroyd-B model, the fractional Burgers model, etc. The second grade fluid model is a sub-model of differential type fluids whereas the other models (Maxwell, Oldroyd, and Burgers) form a subclass of rate-type fluids. According to Tan and Mingyu [6], the starting point of fractional derivative model of non-Newtonian fluids is usually a classical non-Newtonian model, which is modified by replacing the time derivative of an integer order by Riemann–Liouville fractional derivative i.e. a time derivative of fractional order. In the earlier studies, Friedrich [7] generalized the ordinary Maxwell fluid model to the fractional Maxwell model and studied it as a function of the relaxation and retardation times. Tan et al. [8] addressed in a short note unsteady flows of a viscoelastic

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Bose-Einstein Condensation in One-Dimensional Optical Lattices: Bogoliubov's Approximation and Beyond

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Synthesis and Reactivity of Enaminones: Synthesis of Some 1,3,4-Thiadiazole Linked to Pyrazole, Pyridine, Benzimidazolopyrimidine, Pyrazolopyrimidine, Pyrazolotriazine and Triazolotriazine Derivatives

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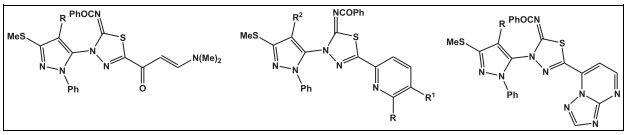

1,3,4-Thiadiazole-enaminone (**6**) was synthesized via reaction of the benzamide (**5**) with DMF-DMA. The simple thiadiazole-enaminone (**6**) was used as a synthetic precursor for the synthesis of a wide variety of new heterocyclic compounds, including the 5-substituted-1,3,4-thiadiazole derivatives (**7**), (**8**), (**16**), (**17**) and (**18**), which were obtained via reactions of (**6**) with nitrogen nucleophiles. Also, reactions of enaminone (**6**) with carbon nucleophiles afforded the respective 1,3,4-thiadiazoles (**10a**,**b**). Diazotization of the benzamide (**20**) with the heteroaromatic amine salts gave the hydrazone derivatives (**21**) and (**22**). Cyclization of the latter hydrazones yielded the corresponding pyrazolotriazine and 1,2,4-triazolotriazine derivatives (**23**) and (**24**), respectively. All newly synthesized compounds were elucidated by considering the data of both elemental and spectral analysis.

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INTRODUCTION

Benzimidazole is an interesting heterocyclic ring system because it is present in naturally occurring cyanocobalamin and several known commercialized drugs such as mebendazole, astemizole, and emedastine difumarate. Moreover, they have shown anthelmintic [1] and antimicrobial activities [2–4]. Also, many benzimidazole derivatives are used as inhibitors of HIV-1 that causes AIDS [5–7] as well as anticancer agents [8].

Pyrazole shows bioactivity and have pharmacological properties and because of the wide range of biological activity demonstrated by this class of compounds for uses such as pharmaceuticals and agricultural and veterinary drugs [9–11]. They possess antiobesity [12], antianxiety [13] and HIV-1 reverse transcriptase inhibitor [14], antihyperglycemic, antipyretic, analgesic, anti-inflammatory and hypoglycemic activity [15,16]. Their derivatives are used as important intermediates in the preparation of drug molecules, as well as in the laboratory synthesis of natural products.

Derivatives of thiadiazoles and triazole are known to exhibit anti-inflammatory, antiviral, analgesic, antimicrobial, anticonvulsant and antidepressant activity, the latter being usually explored by the forced swim test [17]. Among the pharmacological profiles of thiadiazoles and triazoles, their antimicrobial and anticonvulsant properties seem to be the best documented.

Fused heteroaromatic systems are often of much greater interest in biological activity than the constituent monocyclic compounds. 1,2,4-Triazolo[1,5-a]pyrimidines have diverse pharmacological activities, such as antitumor potency, antimalarial, antimicrobial, anti-inflammatory, inhibition of kinase insert domain receptor kinase (KDR), antifungal and macrophage activation [18].

The pyridine nucleus is prevalent in numerous natural products and is extremely important in chemistry of biological systems. It plays a key role catalyzing both biological and chemical system. The pyridine substructure is one of the most important heterocycles found in natural products, pharmaceuticals, and functional materials [19]. Pyridine derivatives containing multi-functional groups such as streptonigrin, streptonigrone and lavendamylcin are reported as anticancer drugs, and cerivastatin is reported as HMG-CoA enzyme inhibitor. Moreover, substituted pyridines are reported as leukotriene B-4 antagonists [19]. Also, enaminones are polydentate reagents that have been utilized extensively in this decade as building blocks in organic synthesis [20–27].

In view of the previously mentioned findings and in continuation of our previous work aimed at the synthesis of a variety of heterocyclic ring systems for biological and pharmacological evaluation [28–37], we report here an efficient method for the synthesis of some pyrazole, 1,3,4-thiadiazole, pyridine and 1,2,4-triazolo[1,5-a] pyrimidine derivatives attached to benzimidazole moieties.

Analytical/Numerical Study of Fluid Flow and Heat Transfer Across In-Line Cylinders

By:Khan, WA (Khan, Waqar A.)[1,3] ; Khan, OU (Khan, Ovais U.)[2]

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Abstract

An integral approach to boundary-layer analysis is employed to investigate the effects of the longitudinal-pitch ratio on fluid flow and heat transfer from a longitudinal row of circular cylinders immersed in an infinite medium. The momentum equation is solved using the modified von Karman-Pohlhausen method, which employs a fourth-order velocity profile within the hydrodynamic boundary layer. The potential-flow velocity is obtained by complex potential theory outside the boundary layer. A third-order temperature profile is used in the thermal boundary layer to solve the energy integral equation for the isothermal boundary condition. Closed-form solution is obtained for the heat transfer coefficient for a longitudinal row of circular cylinders immersed in an infinite medium. In the second part of this research activity, a numerical model based on computational fluid dynamics is developed to validate the closed-form solution. The proposed numerical model has been successfully implemented for simulating the flowfield over a longitudinal row of circular cylinders. Numerical simulations have been carried out for various values of the freestream Reynolds number and longitudinal-pitch ratio. The results obtained from the analytical and numerical models have been found to be in good agreement. The maximum percentage error in values of the average Nusselt number obtained from the numerical and analytical solutions is less than 9% and reduces further to a value of less than 4% with an increase in values of the freestream Reynolds number.

Keywords

2 PARALLEL PLATES; CROSS-FLOW; CIRCULAR-CYLINDER; LONGITUDINAL PITCH; FORCED-CONVECTION; REYNOLDS; BANK; TUBE; EQUATION; NUMBERS

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REVIEW

Down Syndrome—A Narrative Review with a Focus on Anatomical Features

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Down syndrome (DS) is the most common aneuploidy of chromosome 21, characterized by the presence of an extra copy of that chromosome (trisomy 21). Children with DS present with an abnormal phenotype, which is attributed to a loss of genetic balance or an excess dose of chromosome 21 genes. In recent years, advances in prenatal screening and diagnostic tests have aided in the early diagnosis and appropriate management of fetuses with DS. A myriad of clinical symptoms resulting from cognitive, physical, and physiological impairments caused by aberrations in various systems of the body occur in DS. However, despite these impairments, which range from trivial to fatal manifestations, the survival rate of individuals with DS has increased dramatically from less than 50% during the mid-1990s to 95% in the early 2000s, with a median life expectancy of 60 years reported recently. The aim of this narrative review is to review and summarize the etiopathology, prenatal screening and diagnostic tests, prognosis, clinical manifestations in various body systems, and comorbidities associated with DS. Clin. Anat. 29:568–577, 2016.

Key words: Down syndrome; trisomy 21; autosomal aneuploidy; phenotype; morbidity; mortality

Abbreviations used: ALL, acute lymphoblastic leukemia; AFP, alpha fetoprotein; AML, acute myeloid leukemia; AAI, atlantoaxial instability; β-hCG, human chorionic gonadotrophin β-subunit; cf-DNA, cell-free DNA; CI, confidence interval; DS, down syndrome; FISH, fluorescence *in situ* hybridization; NT, nucal translucency; PAPP-A, pregnancy-associated plasma protein-A; TSH, thyroid stimulating hormone; μE3, unconjugated estriol; VSD, ventricular septal defects.

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HYPERGROUPS AND FUZZY SETS ASSOCIATED MODULO A SUBGROUP

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Abstract. This paper is the results of the ideas suggested by P. Corsini in his paper [10]. Our investigations take in account the paper [13] of I. Cristea. We study the hypergroup generated by the cosets modulo a subgroup (normal subgroup). We prove that $(G/H, \circ_4)$ is a complete hypergroup. We take many particular examples to illustrate some known results on hypergroups.

Keyword: fuzzy sets, hypergroups, complete hypergroup, hyperoperation.

1. Introduction

Since the introduction of the concept of fuzzy subgroup of a given group, by A. Rosenfeld [22]; the notions of different fuzzy algebraic structures have been introduced and intensively studied worldwide. Many results on group theory have be extended in a natural way to fuzzy groups. Later, B. Davvaz and his collaborators generalized the notion of fuzzy subgroup: They defined the concept of fuzzy subhypergroup of a hypergroup. In the same way many Other relations establishing the relationship between hyperstructures and fuzzy sets were stated by P. Corsini. He associated a join space to a fuzzy set and a fuzzy set to a join space. These connections lead to a sequence of fuzzy sets and join spaces. The sequence ends if two consecutive join spaces are isomorphic. This argument has been studied in depth by I. Cristea in her PhD thesis. Moreover in [28], M. Stefanescu together with I. Cristea studied the above sequence in the general general and particularly for a complete hypergroup. P. Corsini and I. Cristea [5] determined the fuzzy grade of a particular non-complete 1-hypergroup. In the same way I. Cristea investigated [14] the sequences of join spaces associated the case of a hypergroupoid using fuzzy sets endowed with two membership functions.

Deposition of monomeric C-reactive protein as evidence of localised neurodegenerative diseases

By:Al Hsinawi, M (Al Hsinawi, M.)[1] ; Al Baradie, R (Al Baradie, R.)[1,2]

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Abstract

Monomeric-C-reactive protein (mCRP) is deposited in significant quantities within the brain parenchyma after stroke. Since we have recently identified a possible role of this protein in supporting neurodegeneration and aberrant vascular development, we identified a small group of post-mortem brain samples from individuals who had AD and on histological examination, evidence of tissue infarction/micro-infarction. Here we show that mCRP deposition is highest in those regions affected by stroke or vascular disruption, and that within those same areas, there is more interaction and co-localization between major classical proteins of neurodegeneration (beta-amyloid and tau. We hypothesise that vascular disruption and concomitant release of mCRP within the brain tissue could exacerbate ongoing neurological damage via stimulation of neuro-inflammation and from direct consequences of its action on both neuronal and vascular health.

Keywords

Author Keywords:MONOMERIC C-REACTIVE PROTEIN; STROKE; ALZHEIMER'S DISEASE; NEURODEGENERATION; VASCULAR DEMENTIA

KeyWords Plus:ALZHEIMERS-DISEASE; ISCHEMIC-STROKE; ANGIOGENESIS; INFLAMMATION

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Mechanical and Thermal Properties of Carbonized PAN Nanofibers Cohesively Attached to Surface of Carbon Fiber Reinforced Composites

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Summary: Unidirecitonal pre-preg carbon fibers of ten peel plies were laid up at 0-, 45-, −45-, and 45-degree stacking sequences on a flat and smooth aluminum (Al) plate, and then carbonized electrospun polyacrylonitrile (PAN) nanofibers were placed on top of the last ply prior to vacuum curing in a vacuum oven. The PAN electrospun fibers were oxidized at 280°C in an ambient condition for 1 hr and then carbonized at 850°C for 1 hr in an argon (Ar) gas atmosphere. The resultant composite panels were cut into small pieces and subjected to a number of different characterization techniques. Thermal mechanical analysis (TMA) measurements clearly showed that significant reinforcement was achieved for the pre-preg/carbonized PAN fiber composites because of the enhanced interfacial bonding between the PAN nanofibers and the matrix. Dynamic mechanical analysis (DMA) tests exhibited a shift of the glass transition temperature of the carbonized PAN nanofiber/composite, which may be helpful for high-temperature applications of the present composites. A Raman spectroscopy peak around 897 cm^{-1} indicated formation of the γ-phase of the carbonized PAN fibers. The highest stretching peak of the CH_2 group was recognized within the range of 2,500–2,800 cm^{-1} for the carbonized fibers. The vibration peak of the C≡N group also appeared at 1,452 cm^{-1} spectrum. TMA determined the coefficient of thermal expansion (CTE), indicating an improvement in stability of the composite material, which can be useful for structural health monitoring (SHM) as well as lightning strikes and electromagnetic interference shielding applications of new carbon fiber composites.

Keywords: carbonization; carbon fiber composites; electrospun PAN nanofibers; thermal and mechanical properties

Introduction

Carbon fibers have been receiving significant attention due to their excellent properties, such as high mechanical strength and moduli, high thermal and electrical conductivity, good corrosion resistance, high fatigue strength, high creep resistance, and superior stiffness, and as such they are finding widespread applications in heat-treatment materials, high-temperature catalysts, sensors, composite-reinforcement materials, woven composites, structural laminates, membrane based-separation, nanoelectronics, and photonics.[1,2] Carbon nanofibers are multifunctional and one-dimensional nanomaterials, which are being used in advanced polymer matrix composites due to their outstanding properties and low density.[3] They behave elastically until failure, possess a low coefficient of thermal

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Synthesis and Analysis of Electrospun $SrTiO_3$ Nanofibers with NiO Nanoparticles Shells as Photocatalysts for Water Splitting

Abdulaziz Alharbi,[1] *Ibrahim M. Alarifi*,[1] *Waseem S. Khan*,[2] *Ramazan Asmatulu**[1]

Summary: The coaxial electrospinning process was used to produce core/shell strontium titanate/nickel oxide ($SrTiO_3$-NiO) nanofibers. First, poly (vinyl pyrrolidone) (PVP) was dissolved in deionized (DI) water, and then titanium (IV) isopropoxide [$C_{12}H_{28}O_4Ti$] and strontium nitrate [$Sr(NO_3)_2$] were added into the solution to form the inner (core) layer. Polyacrylonitrile (PAN) polymer was dissolved in dimethylformamide (DMF) at a weight ratio of 10:90. Nickel oxide was mixed with the solution to form the outer (shell) layer. This coaxial electrospinning method generated uniform-size, defect-free fibers. The electrospun nanofiber samples were annealed at 600°C for two hours in air in order to remove the organic part and crystallize the amorphous $SrTiO_3$-NiO nanofibers. Water contact angles were determined to identify surface hydrophobicity of the nanofiber films. Ultraviolet (UV) spectrophotometry, Fourier transform infrared radiation (FTIR), and differential scanning calorimeter (DSC) techniques were used to characterize the structural properties of the $SrTiO_3$-NiO nanocomposite fibers. The morphology and dimensions of the nanofibers were observed by scanning electron microscopy (SEM). The images showed fluctuation in the fiber diameters because of the two different polymeric solutions electrospun at the same time. The structures of the calcined nanofibers were determined by Raman spectroscopy and X-ray diffraction (XRD), which clearly indicated the formations of $SrTiO_3$ and NiO nanofiber structures. The fabrication of such core/shell $SrTiO_3$-NiO nanofibers through coaxial electrospinning suggests the further enhancement and development of photocatalytic behaviors of the new nanomaterials. This study can provide useful information for scientists, engineers, and manufacturers working in renewable energy and related fields, such as water splitting, sensors, solar cells, and catalysts.

Keywords: coaxial; core/shell nanofibers; crystallization; nanoparticles; water splitting

Introduction

The combustion of fossil fuels, such as gasoline, coal, natural gas and oil, has resulted in air pollution and climate changes due to increased emissions of polluting gases, including carbon monoxide, carbon dioxide, nitrogen, nitrous oxide, sulfur oxides, volatile organic compounds, water vapors, and heavy metals.[1,2] Air pollution causes global warming, and the impacts of global warming include primary and secondary pollutants, melting glaciers, coastal erosion, and some infectious diseases. Global warming is usually caused by man-made carbon-associated gas emissions, also known as greenhouse gases, and results in enormous climate changes. The major source of carbon emissions is the combustion of fossil fuels, such as coal, oil, and gas in power plants, automobiles, other transportation vehicles,

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Thermodynamic analysis of gas turbine with air bottoming cycle

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ABSTRACT

In this study, thermodynamic analysis of a gas turbine cycle with air bottoming cycle is presented to compare the efficiency ratios with modified gas turbine cycle as well as with conventional combined cycle. Both the modified gas turbine and modified gas turbine with air bottoming cycles consist of an intercooler and reheat exchangers. First and second laws of thermodynamics are employed in the analysis of each cycle. Codes are written in MATLAB to solve the equations at different operating conditions and efficiencies are calculated. The effects of pressure ratio of the topping gas turbine cycle ($3 \leq pr_{g_1} \leq 15$) and the pressure ratio of the bottoming gas turbine cycle ($3 \leq pr_{g_2} \leq 12$) on the thermal efficiency ratio and the work output are explored. It is observed that the basic gas turbine cycle with air bottoming cycle has a 4.78% higher efficiency than the basic gas turbine at their maximum efficiencies. Comparisons of thermal efficiency ratio and work output are presented for various combinations of each cycle. It is found that modified gas turbine with air bottoming cycle produces 1.27-fold higher work output than the modified gas turbine cycle at their maximum efficiencies. But it has less thermal efficiency and less work output than the combined cycle at all operating conditions. The exergy analysis shows that the use of the gas turbine bottoming cycle reduces the total exergy destruction of simple gas turbine by 6%. The exergy loss with the exhaust gas of simple gas turbine constitutes a large portion of 47% of the total exergy destruction. This is reduced to 31% for gas turbine with air bottoming cycle.

1. Introduction

In conventional power plants, gas turbine is the major source of power generation in many countries. The gas turbine works on the principle of Brayton cycle in which compressed air from the compressor enters the combustion chamber. The high pressure and high temperature combustion products from the combustion chamber enter the gas turbine where they expand to low pressure and produce the work [1]. Due to incomplete combustion in the combustion chamber as well as short expansion of high pressure and high temperature combustion products in the gas turbine, a lot of energy gets lost to the environment which not only pollutes the environment but also plays the vital role in global warming. Sometimes this lost energy is abundant that is capable to run another thermal power plant. The turbine exhaust temperature of a simple gas turbine is in the range of 370–540 °C but usually above 500 °C [2]. Accordingly, the hot exhaust gases have significant thermodynamic utility (exergy) that would otherwise be lost when the exhaust gas discarded directly to the surroundings.

One way of utilizing this potential is by means of internal heat recovery in which exhaust gas is utilized as the source of heat. The various methods being employed include a regenerative heat exchanger and steam injection. The regenerative heat exchanger allows the air exiting the compressor to be preheated before entering the combustor, thereby reducing the amount of fuel that must be burned in the combustor. With the steam injection method, the thermal energy of the exhaust gas is transferred to an auxiliary fluid (water) in HRSG (heat recovery steam generator) unit which is then injected into the combustor. In the HRSG unit, water passes in a counter flow with the exhaust gas into three separate heat exchangers: economizer, vaporizer and superheater. Steam injection increases the turbine work by increasing the mass flow rate of the working fluid and its specific heat [3]. In addition to an increase in turbine output, steam injection method has the advantage of controlling NO_x emissions from the gas turbine combustor [4].

The combined cycle arrangement is another way to utilize the hot exhaust gas. The energy source for the bottoming cycle such as a steam cycle is the hot exhaust gas from the topping cycle. The

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Research Paper

Electrothermal effect on the immunoassay in a microchannel of a biosensor with asymmetrical interdigitated electrodes

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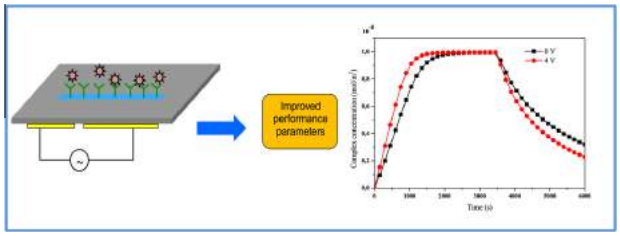
HIGHLIGHTS

- AC electro-thermal flow and heat generation have been studied.
- The temperature boundary condition influences significantly the binding rate.
- Highest electrical conductivity causes the stronger electrothermal flow.
- Lower substrate thermal conductivity raises the binding rate.

GRAPHICAL ABSTRACT



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ABSTRACT

In this paper, we study the AC electrothermal (ACET) effect on the binding reaction of immunoassays which a ligand (anti-C-reactive protein) immobilized on a microchannel wall specifically binds analyte (C-reactive protein (CRP)) flowing through a configuration of a microchannel with asymmetrical planar electrode pairs. The Navier–Stokes equations coupled with the Laplace and energy equations, the Fick's second law in convection–diffusion coupled with the first order Langmuir adsorption model are used. The set of equations is solved in a two-dimensional configuration using the finite element method. Three cases of the thermal boundary conditions are investigated to study the effect of the temperature field on the binding reaction efficiency. The electrical conductivity of the buffer solution, the thermal conductivity of the base material and the surface reaction length are also discussed in this work. The simulation results show that the heterogeneous immunoassay is improved when the external surfaces of the cover and the substrate are kept at a constant temperature. For the best case studied in this work, the enhancement factors of the binding curve can be raised up to 3.46 and 2.84 for the association and dissociation phases, respectively, with 4 V_{rms} applied voltage and operating frequency of 100 kHz and electrical conductivity of 0.01 S/m.

1. Introduction

Microfluidics-based biosensors and biochips have given impetus to develop immunoassays, protein separation, DNA sequencing and tremendous applications in life sciences and medical diagnosis [1–3]. Heterogeneous immunoassays, is a powerful biomedical diagnostic tool based on the interaction between free analyte

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Enhancement of the Analyte Mass Transport in a Microfluidic Biosensor by Deformation of Fluid Flow and Electrothermal Force

Fluid deformations around a cylinder combined with an applied electric field are used to enhance the kinetics rate and the response time of heterogeneous immunosensors in microfluidic systems. The insertion of an obstacle in the microchannel as well as the application an applied electric field are used to change the fluid motion topology that improves the transport of diffusion-limited proteins. The response time is affected by various parameters such as the inlet flow velocity, the initial analyte concentration and the obstacle position. The effects of the parameters related to the kinetics reaction on the sensitivity and the performance of the biosensor have been studied numerically. Numerical results reveal that an appropriate choice of the inlet analyte and inlet flow velocity with applied electric field may reduce considerably the response time and enhance the microfluidic sensor performance. [DOI: 10.1115/1.4033484]

Introduction

Microfluidics mixed with nanotechnology has played a major role in tremendous developing microelectromechanical systems or lab-on-chip systems [1–5]. These devices have found great applications in medical diagnostics, chemical and biological analysis, and even immunoassays [6–8]. They have offered many advantages including high throughput, short analysis time, real-time analysis and the ability to operate with small samples and high sensitivity [9]. Recently, much attention to experimental and theoretical research has been drawn for finding optimized strategies for microfluidic biosensors. The surface plasmon resonance sensor [10,11], the quartz crystal microbalance sensor [12,13], the impedance-based sensor [14] and the immunoassays are the principal methods used in most cases for the quantitative monitoring of biomolecules. Although the processes of detection are different, they all implicate the same kinetics of specific binding of analytes and immobilized ligands. More specifically, the system mixes a small concentration of a biological analyte, such as C-reactive protein (CRP), with the fluid in a microchannel. The binding efficiency on the reaction surface is usually large enough to bind practically all analyte molecules appearing there. Thus, the reaction is said to be transport limited and it usually causes the formation of a diffusion boundary layer [15]. The development of the diffusive layer causes the limitation of the response time and the performance of the biosensor [16]. Therefore, to overcome the problem of the development of the diffusion boundary layer and to improve the detection time, a number of strategies are currently available including the AC electrokinetic forces to enhance the reactant transport rate to a reaction surface on the wall of a microchannel. In the last decade, several experimental and theoretical studies that used the AC electrokinetics, have been developed to improve the microfluidic biosensors response [17–25]. Microfabricated electrodes integrated in microfluidic devices are commonly employed to generate an electric field [26,27]. Conventionally, AC electrokinetics includes three forces: AC electroosmosis (ACEO), AC electrothermal (ACET), and dielectrophoresis (DEP) [28]. The DEP has been exploited to manipulate particles, capture DNA and separate cancer blood cells. ACEO has been utilized for pumping fluids under low applied field frequencies below 10 kHz [29] whereas the AC electrothermal effect has been tremendously used in the past few years in several researches for biological applications at higher frequencies [30]. Consequently, the electrothermal force is only considered in our study.

In this paper, we develop a novel approach using fluid transformations in order to enhance the binding efficiency of immunoassay for a microfluidic biosensor. A cylinder is integrated in the microchannel with a pair of electrodes. Combining the flow deformations induced by the cylinder with the mechanism provided by the electrothermal effect, we investigate the effect of the flow deformation around the cylinder on the reduction of the diffusion boundary layer. In addition, we study the effect of some important factors such as the average inlet flow velocity and the initial analyte concentration that control the immunoreaction in the microfluidic biosensor and its response time.

Theoretical Formulation

Our main purpose is to compute the rate of the kinetics binding reaction between an analyte A (such as CRP) and a ligand B (antiCRP). The analyte A is carried by a fluid toward a sensitive membrane in which the ligands are immobilized.

The investigated device is a rectangular microchannel containing a sensitive membrane on the top wall. A pair of electrodes is

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Shear work, viscous dissipation and axial conduction effects on microchannel heat transfer with a constant wall temperature

K Ramadan[1] and Iskander Tlili[2]

Abstract

Convective heat transfer in a microchannel rarefied gas flow with a constant wall temperature boundary condition is investigated numerically. The boundary shear work, viscous dissipation and axial conduction are all included in the study. An analytical solution is also derived for the fully developed flow condition including the boundary shear work. The proper thermal boundary condition considering the sliding friction at the wall is implemented. A comparative study is performed to quantify the effect of the shear work on heat transfer in the entrance – and the fully developed – regions of the microchannel for both gas cooling and heating. The results demonstrate that the effect of shear work on heat transfer is significant and it increases with increasing both the Knudsen number and Brinkman number. Neglecting the shear work in a microchannel slip flow leads to over- or under estimation of the Nusselt number considerably. For a fully developed flow in a microchannel with constant wall temperature boundary condition, the contribution of the shear work to heat transfer can be around 55% in the vicinity of the upper limit of the slip flow regime, regardless of how small the non-zero Brinkman number can be. Including the shear work is therefore crucial in the analysis of microchannel heat transfer and should not be neglected.

Keywords

Microchannel, velocity slip, temperature jump, shear work, viscous dissipation, sliding friction, slip flow

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Introduction

Heat transfer in micro conduits has been studied extensively in the past and current decades. Some of the major issues that have been investigated are the velocity slip and temperature jump conditions, viscous dissipation, thermal creep and compressibility effects. The effect of the shear stress work at the boundary (the work done by the slipping fluid on the surface) on heat transfer in slip flow was first studied by Maslen.[1] Sparrow and Lin[2] and Inman[3] later included the shear work for the calculation of the wall heat flux in slip flow. Hong and Asako[4] presented physical explanations for including the shear work in the heat balance equation at the wall using both the energy conservation principle and the kinetic theory of gases. Hong and Asako[4] explained the implementation of the shear work for three different boundary conditions, namely the constant wall temperature (CWT), constant wall heat flux and adiabatic boundary conditions. Hadjiconstantinou[5] discussed the effect of the boundary shear work on convective heat transfer in small scale channels and showed that the shear work scales with the Brinkman number. An expression for the fully developed slip flow Nusselt number under constant wall heat flux conditions in the presence of viscous dissipation was also derived in literature.[5] It was concluded that the shear work at the boundary has been incorrectly neglected in recent studies of slip flow convective heat transfer with viscous dissipation. A comprehensive and critical review on microflows in the slip flow regime was conducted by Colin.[6] The author concluded that most of the existing theoretical models in the literature of heat convection in gas microflows should be corrected by including the non-negligible shear work when viscous dissipation is taken into account.

There are only few investigations in the literature of convective heat transfer in microchannels that consider the shear work effects on heat transfer. Shi et al.[7] investigated choked flow of a low-density gas in a

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Estimation of boundary-layer flow of a nanofluid past a stretching sheet: A revised model*

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Abstract: The previous model for the boundary layer nanofluid flow past a stretching surface with a specified nanoparticle volume fraction on the surface is revisited. The major limitation of the previous model is the active control of the nanoparticle volume fraction on the surface. In a revised model proposed in this paper, the nanoparticle volume fraction on the surface is passively controlled, which accounts for the effects of both the Brownian motion and the thermophoresis under the boundary condition, whereas the Buongiorno's model considers both effects in the governing equations. The assumption of zero nanoparticle flux on the surface makes the model physically more realistic. In the revised model, the dimensionless heat transfer rates are found to be higher whereas the dimensionless mass transfer rates are identically zero due to the passive boundary condition. It is also found that the Brownian motion parameter has a negligible effect on the Nusselt number.

Key words: boundary layer flow, nanofluid, stretching sheet, Brownian motion, thermophoresis

Introduction

Buongiorno[1] developed a model for nanofluid that includes both the Brownian motion and thermophoresis effects. This model was employed by Kuznetsov and Nield[2] and Nield and Kuznetsov[3] to examine the influence of nanoparticles on the free convection past a vertical plate. They employed boundary conditions with respect to the nanoparticle fraction akin to the temperature. Later on, Khan and Pop[4] employed the same model to investigate the laminar flow generated by the stretching of a flat surface. They studied the effects of Brownian and thermophoresis parameters on the dimensionless heat and mass transfer rates using the same approach as used in Refs.[2,3]. This means that the nanoparticle fraction on the wall can be specified arbitrarily, which is not realistic physically. Most recently, Kuznetsov and Nield[5,6] developed a physically realistic type of boundary condition which accounts for the effect of both Brownian and thermophoresis parameters. According to this new type of boundary condition, there is zero nanoparticle flux on the surface and the particle fraction values are adjusted accordingly. The model developed in Kuznetsov and Nield[5,6] was employed by Khan et al.[7,8].

Pal and Mandal[9] studied the magnetohydrodynamic boundary layer flow of an electrically conducting convective nanofluids induced by a non-linear vertical stretching/shrinking sheet with viscous dissipation, thermal radiation, and Ohmic heating. Their results reveal that by increasing the value of the Hartman number the velocity will decrease, whereas a reverse effect is found in the temperature profiles. Das[10] investigated numerically the boundary layer

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ORIGINAL ARTICLE

Crystal structure and chemotherapeutic efficacy of the novel compound, gallium tetrachloride betaine, against breast cancer using nanotechnology

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Abstract The objective of this study was to investigate the antitumor efficacy of a novel synthesized compound, betaine gallium-tetrachloride (BTG), alone or combined with ZnO-nanoparticles (BTG + ZnO-NPs) on the incidence of 7, 12-dimethylbenz-anthrathene-induced mammary tumor in female rats. Crystal and molecular structure of the prepared BTG were identified using X-ray crystallography. In vitro study revealed BTG more cytotoxic than BTG + ZnO-NPs on human breast cancer (MCF-7) cell line. In vivo study demonstrated that the blood antioxidant status of tumor-bearing rats (DMBA group) was significantly lower than normal noticeable by a significant decrease in GSH content, GPx, SOD, and CAT activities associated with a significantly high MDA content. Both treatments have significantly elevated SOD and CAT activities with a concomitant decrease of MDA level compared to DMBA group. However, BTG + ZnO-NPs accentuated the decrease of GSH regarding DMBA group. The results showed also that both treatments significantly activate caspase-3 enzyme and apoptosis in mammary glands. Their administration to tumor-bearing rats was found to significantly reduce plasma iron and iron-binding capacity (TIBC) compared to DMBA group. Regarding liver function, both treatments significantly reduced the increase of ALT and AST activities compared to DMBA group. However, BTG + ZnO-NPs decreased albumin below normal level. Histopathological studies showed that normalization of tissue structures was higher in BTG than BTG + ZnO-NPs treatment. According to the results obtained, it is observed that the antitumor effect of BTG alone was as strong as BTG + ZnO-NPs and even more efficient in some aspects accordingly, a combination is not needed. Thus, the novel synthetic gallium derivatives may potentially present a new hope for the development of breast cancer therapeutics, which should attract further scientific and pharmaceutical interest.

Keywords Breast cancer · Gallium trichloride · Betaine · ZnO-nanoparticles

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Introduction

Breast cancer originates mostly from the inner lining of milk ducts or the lobules that supply the ducts with milk, in humans and other mammals [1, 2]. The World Health Organization (WHO) has ranked breast cancer as the most common type of neoplastic diseases among women worldwide, accounting for up to one third of new diagnoses of women's cancer in certain regions of the world [3]. Comprehensive unbiased studies of tumors and patient populations have significantly advanced molecular understanding of breast cancer, but translating these findings into clinical practice remains a challenge.

One of the agents which previously has been identified to be responsible for the development of neoplasia is the polycyclic aromatic hydrocarbon 7, 12-dimethylbenz[a]anthracene (DMBA), which is an immune suppressor as well as a potent organ-specific carcinogen [4]. The mechanism by which DMBA works relies on its capability of inducing oxidative stress and

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Molecular and histological changes in cerebral cortex and lung tissues under the effect of tramadol treatment

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ABSTRACT

Tramadol abuse is one of the most frequent health problems in Egypt and worldwide. In most cases, tramadol abused by men face a problem with premature ejaculation. Tramadol like other opioids induces a decrease in plasma antioxidant levels, which may reflect a failure of the antioxidant defense mechanism against oxidative damage. The present work aimed to study the possible deleterious effects of oral administration of tramadol on brain and lung tissues in rats. Twenty adult male albino rats were divided into two groups; a control administered with normal saline and tramadol-treated (40 mg/kg b.w.) group for 20 successive days. At the end of experimental period, blood was collected and specimens from brains and lungs were taken for histopathological and molecular studies. Malondialdehyde (MDA), reduced glutathione (GSH), superoxide dismutase (SOD) and catalase (CAT) activities were measured in serum of control and tramadol-treated groups. Brain and lung specimens were histopathological evaluated using light microscopy. The expression levels of apoptotic related genes; Bcl-2, Bax and Caspase-3 were study in brain and lung tissues using RT-PCR analysis. We recorded a significant increase MDA level, while antioxidant enzymes; GSH, SOD and CAT were significantly decreased after tramadol-treatment. The obtained results revealed that tramadol induced a remarkable histomorphological changes in rats' brains (cerebral cortex and hippocampus) and severe histopathological changes in rats' lung when compared to that of control. On molecular level, the expression of the pro-apoptotic Bax and Caspase-3 showed a significant increase whereas the anti-apoptotic Bcl-2 decreased markedly indicating that tramadol is harmful at cellular level and can induce apoptotic changes in brain tissues. Our data confirmed the risk of increased oxidative stress, neuronal and pulmonary damage due to tramadol abuse. Although tramadol is reported to be effective in pain management, its toxicity should be kept in mind.

1. Introduction

Tramadol belonged to a synthetic opioid of the aminocyclohexanol group; it is analgesic used effectively in pain treatment in experimental and clinical studies [30]. Tramadol administration efficiently alleviates pain in acute and chronic conditions [55]. The neurotoxicity of abusing drugs are usually related to oxidative stress, mitochondrial dysfunction, apoptosis, and inhibition of neurogenesis [11]. Tramadol toxicity and abuse were announced as an atypical opioid as it produces analgesia by the synergism between the parent drug and its o-desmethylated metabolites [65]. It follows a complex pathway that is responsible for opioid receptor-mediated analgesia and inhibition of neuronal re-uptake of nor-epinephrine and serotonin [44,59].

At a cellular level, lipid peroxidation (LPO) production reflects the degree of toxicity of opioids [32], because a significant elevation in LPO was found in rats receiving an acute cocaine dose [33]. Similarly, LPO was elevated significantly among chronic heroin dipsomaniac [41]. The previous study found that glutathione level in rat hepatocytes was marked decrease after incubated with morphine, which causes hepatocytes death [68]. Furthermore, the levels of serum Malondialdehyde (MDA) was elevated after treatments with morphine and tramadol indicating an increase in LPO production [3].

Oxidative stress refers to the loss of balance between Reactive Oxygen Species (ROS) level and antioxidant defense system. [8] reported that ROS could induce apoptosis. The free-radicals overproduction causes a mortality to immature cultured cortical neurons [43] and directly produce a damage to DNA [60]. Among

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MHD Fluid Flow and Heat Transfer of Micropolar Ferrofluids Over a Stretching Sheet

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Abstract

This study investigates boundary layer flow and heat transfer of a micropolar ferrofluid over a stretching surface. The selected ferrofluids are made of kerosene oil as a base fluid and a colloidal suspension of ferroparticles namely, Cobalt ferrite (CoFe2O4), Magnetite (Fe3O4) and Mn-Zn ferrite (Mn-ZnFe2O4). Microrotation of the ferroparticles is considered. Using suitable similarity transformations, the governing partial differential equations are converted into a system of non-linear ordinary differential equations. These equations are then solved numerically using a finite difference method with a quasilinerization technique. The effects of different controlling parameters on the dimensionless velocity, temperature, skin friction and Nusselt numbers are investigated for both weak and strong concentrations of ferrofluids. It is found that these parameters have strong effects on skin friction and Nusselt numbers.

Keywords

Author Keywords:Ferrofluid; Micropolar Fluid; Stretching Sheet; Numerical Solution

KeyWords Plus:STAGNATION-POINT FLOW; BOUNDARY-LAYER-FLOW; THERMAL-CONDUCTIVITY; MIXED CONVECTION; SHRINKING SHEET; NANOFLUIDS; SURFACE; PLATE; DRIVEN

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Analysis of MHD Nanofluid Flow Over a Convectively Heated Permeable Vertical Plate Embedded in a Porous Medium

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Abstract

The Buongiorno model has been used to numerically investigate the boundary layer flow of an electrically conducting water-based nanofluid past a permeable vertical plate embedded in a porous medium in the presence of magnetic field. The model used for the nanofluid incorporates the effects of Brownian motion and thermophoresis through constituent equations. In addition, we assumed that there is no nanoparticle flux at the surface and the effect of thermophoresis is taken into account in the boundary condition. A self-similar numerical solutions is presented which depends on the magnetic parameter M, nanofluid buoyancy ratio Nr, Eckert number Ec, Lewis number Le, Brownian motion number Nb, thermophoresis number Nt and suction/injection parameter f(w). The dependency of the Nusselt number on these parameters is investigated and correlation based estimation has been provided.

Keywords

Author Keywords:MHD; Buongiorno Model; Nanofluids; Vertical Plate; Porous Medium; Nusselt Number

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Journal of Applied Polymer Science

Investigating the thermal, mechanical, and electrochemical properties of PVdF/PVP nanofibrous membranes for supercapacitor applications

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ABSTRACT: Polyvinylidene fluoride and polyvinylpyrrolidone polymers incorporated with carbon black nanoparticles (50 nm) were electrospun to fabricate nanofibrous membranes for supercapacitor separators. Different weight percentages (0, 0.25, 0.5, 1, 2, and 4 wt %) of carbon black nanoparticles were dispersed in *N*,*N*-dimethylacetamide and acetone prior to the electrospinning processes at various voltage, pump speed, and tip-to-collector distances. The morphology, thermal, mechanical, hydrophobic, and electrochemical characterization of nanofibrous membrane were analyzed using different techniques, such as scanning electron microscopy, differential scanning calorimetry, capacitance bridge, thermogravimetric analysis, dynamic mechanical analyzer, and water contact angle. Effects of annealing and UV irradiation exposures on the nanofibrous membranes were investigated in detail. Test results revealed that the physical properties of the nanocomposite separators were significantly enhanced as a function of carbon black inclusions in the polymeric structures, which may be useful for the applications of supercapacitor separators and other energy storage devices.
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INTRODUCTION

New-generation energy storage devices have been receiving considerable attention recently due to the skyrocketing prices of fossil fuel and the desire to meet the ever increasing demand of energy. These devices can be used as backup source devices due to their long cyclic lives with a high charging-discharging rate, excellent power density, low electrical resistivity, and large surface area compared to conventional capacitors and batteries. They have displayed remarkable performance in a wide range of applications such as power backup in some electrical devices and as a power source for hybrid vehicles.[1–6] Research on novel energy storage devices has been considered in order to replace batteries, which have slow discharge rates and a high energy density. Accordingly, it is important to develop storage devices having high energy density and high power density.[7] Supercapacitors are energy storage devices having intermediate features between batteries and traditional capacitors. They can be charged and discharged a number of times without suffering the effects of aging. Supercapacitors work well under hot and cold temperatures. Under normal conditions, a supercapacitor fades very little after being used for several years. In supercapacitors, the capacitance performance depends largely on the electrolyte/electrode and separator. Different types of materials have been used to fabricate separators/electrodes for supercapacitors, such as metal-based oxides and carbonaceous compositions. Carbon-based compositions such as porous carbon, activated carbon fibers, carbon aerogels, carbon nanotubes, and graphene are the most-often-used substances for supercapacitors.[6–10] Carbon-based nanocomposites with conducting polymers have high capacitance values and better cyclic performance in supercapacitors. They also possess high capacitance values due to their functional groups containing phosphorus, nitrogen, and oxygen, which are referred to as the pseudocapacitance effect.[10]

The search for alternating energy sources is a vital concern and a challenging issue. Although, wind, solar, fuel cells, and nuclear energy have been around for several decades, exploiting these sources on a large-scale requires addressing many obstacles. As a result, increased attention has been given to the electrospinning process for fabricating a nanofibrous membrane for application in a supercapacitor. Electrospinning is a unique process used to fabricate continuous nanosize fibers by using a high-voltage power supply. Nanowoven webs have received significant attention because of the prominent characteristics of these electrospun fibers, such as small diameter ranges, high porosity of the structure, and high surface area. This process is less expensive and simple. Owing to these useful properties, many polymers have been utilized to fabricate fibers that can be employed in a variety of

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Designing a powered combined Otto and Stirling cycle power plant through multi-objective optimization approach

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ABSTRACT

Throughout the recent years, several efforts have been conducted in studying Stirling engine which have yielded various models for analysis of Stirling engine thermal efficiency and output power. In the present study, the applicability of a combined Stirling and Otto cycle power plant where a Stirling cycle engine would serve as a bottoming cycle for a stationary Otto cycle engine is investigated. Output power of Stirling engine and Stirling engine thermal efficiency are optimized and total pressure losses of Stirling engine is optimized executing NSGA approach and finite speed thermodynamic analysis. The outcomes gained are satisfactory verified versus actual recorded data of Stirling engine. Decision making was performed via three well-known methods. Finally, error analysis was performed on the outputs obtained from this optimization.

Contents

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Time–frequency concentration and localization operators in the Dunkl setting

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Abstract The aim of this paper is to prove a mean dispersion inequality that limits the concentration of orthonormal sequences on the time–frequency plane and improves the well-known Heisenberg's uncertainty inequality. Then we define and study a class of pseudo-differential operators known as time–frequency operators and we give criteria for its boundedness and Schatten class properties.

Keywords Time–frequency concentration · Localization operators · Uncertainty principles

Mathematics Subject Classification 42A68 · 94A12 · 42C20 · 42C25 · 42C40 · 45P05

1 Introduction

The Dunkl transform is a generalization of the usual Fourier transform to an integral transform invariant under a finite reflection group. The Dunkl operators T_j; $j = 1, \ldots, d$ associated to an arbitrary finite reflection group G and a nonnegative multiplicity function k are differential-difference operators, generalizing the usual

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Finite-Element Simulations of the pH-ElecFET Microsensors

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***Abstract*— This paper presents a COMSOL Multiphysics 2-D axisymmetric model of a pH-sensitive electrochemical field effect transistor (pH-ElecFET) microsensor. This device combines an integrated microelectrode with a pH-sensitive chemical field effect transistor (pH-ChemFET). Thus, by triggering electrolysis phenomena owing to the integrated microelectrode, associated local pH variations in microvolumes are monitored thanks to the pH-ChemFET microdevice. Taking into account (electro) chemical reactions and diffusion phenomena in the liquid phase, the proposed model points out the role of the ElecFET geometrical design (microelectrode width w, gate sensitive radius r_e and distance between the pH-ChemFET gate and the microelectrode d), as well as polarization parameters, (polarization voltage V_p and time t_p), on the microsensor response. It is first applied to water electrolysis in order to validate pH impulsional variations in microvolume. Then, the oxidation of hydrogen peroxide in phosphate buffer (PBS, $pH_0 = 7.2$) solutions is studied, evidencing the H_2O_2 potentiometric detection in the [10–100 mM] concentration range. This developed model paves new ways for sensor applications, opening several new opportunities for pH-ElecFET devices for H_2O_2-related enzymatic detection of biomolecules.**

***Index Terms*— Modeling, ElecFET, microelectrode, pH -ChemFET, water electrolysis, hydrogen peroxide detection.**

I. Introduction

In THE last decade, the electrochemical microsensors have received an increasing interest in a wide range of applications such as clinical diagnostics, food analysis, environmental monitoring due to their low cost, simple operation, small size, and rapidity, sensitivity and real-time [1]–[3]. The electrochemical sensors can be divided into three groups depending on the measured electrical signal [4]–[6]: amperometric, potentiometric, and conductometric. Even so, the combination of amperometric and potentiometric techniques is a very promising method in terms of detection [7]–[10]. Diallo et al. have developed an electrochemical field effect transistor (ElecFET) microsensor based on this technique [8], [9]. This device is achieved through the integration of a planar noble metal electrode around the dielectric gate area of a pH-sensitive ChemFET microdevice.

By triggering pH-related electrochemical reactions thanks to the microelectrode polarization and by monitoring the so-obtained pH variations thanks to the pH-ChemFET, electrolysis phenomena and pH measurement are closely embedded at the microscale, enabling new electrochemical detection potentialities. Among the ElecFET microdevice applications, the most frequent is the manufacturing of a pH-related enzyme sensor. In this case, the ChemFET detects the pH change resulting from the enzymatic reaction in the membrane that covers the sensor [11]. The output voltage of the ChemFET controls the current flowing through the sensor-actuator system [12]. ElecFET has been successfully used to determine acid or base concentration [13], to form the heart of a carbon dioxide sensor [14] and detect different biomolecules [8], [11].

Various mathematical models of microsensors have been developed and successfully used to study and optimize analytical characteristics of microsensors [15]–[18].

Meena and Rajendran [15] have derived analytical expressions of concentration and current in order to describe and evaluate the performances of amperometric and potentiometric biosensors using homotopy perturbation method. A numerical study of potentiometric and amperometric electrochemical gas sensors based in a solid-state ion conducting electrolyte has presented by López-Gándaraa et al. [16] in order to optimize the diffuse layers covering one of their catalytic electrodes. The model describes the current-voltage characteristics in the system layer/electrode/electrolyte/electrode. A theoretical study and numerical simulation of potentiometric and amperometric enzyme electrodes and of enzyme reactors have been developed by Morf et al. [17], [18]. The response characteristics of potentiometric and amperometric sensor systems, as well as the product release from enzyme reactors, are analyzed, and the influence of the relevant parameters on the steady-state response is demonstrated and discussed [17].

In this paper, we apply the concept of the combination of amperometric and potentiometric techniques to simulate the ElecFET microdevice detection principles, in order to monitor water (H_2O) electrolysis phenomena in a first stage and hydrogen peroxide (H_2O_2) electrochemical detection in the second stage. We then focus on the study of the influences of the main parameters, i.e. (i) polarization voltage V_p and time t_p on the integrated microelectrode, (ii) characteristic of the microelectrode width w, (iii) distance between the gate

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Heat transfer in ferrofluid with cylindrical shape nanoparticles past a vertical plate with ramped wall temperature embedded in a porous medium

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Time dependent wall temperature

ABSTRACT

This paper studies magnetogydrodynamic (MHD) and porosity effects on ferrofluid over an oscillating plate with time dependent wall temperature. Nanoparticles of cylindrical shape are contained inside the base fluids. Kerosene oil is chosen as conventional base fluids. Two types of nanoparticles, magnetite (Fe_3O_4) and non-magnetic (Al_2O_3) are added to the base fluid. The flow is unsteady and the ferrofluid is considered as an electrically conducting due to a uniform magnetic field applied in a perpendicular direction to the plate. The problem is modelled in terms of partial differential equation with some physical conditions and solved by using the Laplace transform technique. Exact solutions are obtained for velocity and temperature for both cases of time dependent and isothermal wall temperatures. Graphs of velocity and temperature for time dependent and isothermal wall temperatures are plotted and compared. It is found that under time dependent wall temperature condition, velocity and temperature are smaller in magnitudes than those obtained under isothermal wall temperature condition. Moreover, effects of porosity and Hartmann number are studied graphically and discussed. A comparison is also made between magnetite (Fe_3O_4) and non-magnetic (Al_2O_3) nanoparticles. Expressions for skin-friction and Nusselt number are computed in tables. Excellent agreement of the present results is found with existing results in the literature. In this work, cylindrical nanoparticles are chosen because of their abundant applications in biology and medicine. For instance, cylindrical nanoparticles are seven times more deadly than traditional spherical nanoparticles when delivering drugs to breast cancer cells.

1. Introduction

Conventional heat transfer fluids such as water, ethylene glycol, propylene glycol, kerosene oil and lubricant oils have poor thermal conductivities. Choi [1] for the first time realised that the rate of heat transfer can be increased by enhancing the thermal conductivities of these fluids. He further elaborated that when a small amount of nanoparticles is added to the above conventional base fluids, it increases significantly their thermal conductivities and convective heat transfer rate. Furthermore, Choi [2] and Kaufui and Omar [3] also investigated that nanofluids are the most capable fluids for enhancing thermophysical properties for instance, viscosity, thermal conductivity, thermal diffusivity and convective heat transfer coefficients compared to those of the conventional base fluids such as water, ethylene or tri-ethylene-glucose and other coolants, bio-fluids and polymer solutions. Major advantages of nanofluids are that they are more stable, have sufficient viscosity and better wetting, spreading and dispersion properties on solid surface even for modest nanoparticle concentrations [4]. Therefore, recently, nanofluids are playing a vital role in the development of modern technology [5].

On the other hand, ferrofluids form a subclass of nanofluids when magnetic nanoparticles in the presence of magnetic field are added to the base fluids. Ferrofluids are also known as magnetic nanofluids. They respond to applied magnetic fields and allow further manipulation of heat transfer and hydrodynamic characteristics [6]. Different types of magnetic nanoparticles can be used for making ferrofluids. However, based on their thermophysical properties magnetite (Fe_3O_4) and aluminum oxide nanoparticles are regarded as the most suitable and hence are chosen for the present work. Applications of ferrofluids are frequently found in different scientific fields. For example, ferrofluids are used in many magnetic fluid based scientific devices such as sensors,

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Synthesis, Analysis and Simulation of Carbonized Electrospun Nanofibers Infused Carbon Prepreg Composites for Improved Mechanical and Thermal Properties

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Abstract: This paper reports the fabrication, characterization and simulation of electrospun polyacrylonitrile (PAN) nanofibers into pre-impregnated (prepreg) carbon fiber composites for different industrial applications. The electrospun PAN nanofibers were stabilized in air at 270 °C for one hour and then carbonized at 950 °C in an inert atmosphere (argon) for another hour before placing on the prepreg composites as top layers. The prepreg carbon fibers and carbonized PAN nanofibers were cured together following the prepreg composite curing cycles. Energy dispersive X-ray spectroscopy (EDX) was carried out to investigate the chemical compositions and elemental distribution of the carbonized PAN nanofibers. The EDX results revealed that the carbon weight % of approximately 66 (atomic % 72) was achieved in the PAN-derived carbon nanofibers along with nitrogen and lower amounts of nickel, oxygen and other impurities. Thermomechanical analysis (TMA) exhibited the glass transition regions in the prepreg nanocomposites and the significant dependence of coefficient of thermal expansion on the fiber directions. The highest value of coefficient of thermal expansion was observed in the temperature range of 118-139 °C (7.5×10^{-8} 1/°C) for 0 degree nanocomposite scheme. The highest value of coefficient of thermal expansion was observed in the temperature range of 50-80 °C (37.5×10^{-6} 1/°C) for 90 degree nanocomposite scheme. The test results were simulated using ANSYS software. The test results may be useful for the development of structural health monitoring of various composite materials for aircraft and wind turbine applications.

Keywords: Electrospun PAN nanofibers, Carbonization, Carbon prepreg composites, Characterization, Simulations

Introduction

Polyacrylonitrile (PAN) is the commonly available precursor for the large scale production of commercial carbon fibers [1,2], activated carbon, and fabrics. This is one of the most inexpensive and easiest methods of carbon fiber production with high carbon yield. The other traditional process used for carbon fiber production is vapor growth or enhanced chemical vapor deposition, which was developed earlier, involves a complicated procedure and relatively high cost [3]. The carbon fibers produced using PAN contains about 99 % carbon by weight which is generally referred to as graphitic fibers [4]. Carbon nanofibers can also be produced by stabilizing and carbonization of Electrospun PAN Fibers.

Electrospinning is a promising technique for the production of carbon nanofibers with PAN being the polymer precursor [5,6]. Several novel techniques of electrospinning processes described a simple, straightforward and cost-effective approach to synthesize fibers with a diameter ranging from sub-micron to nanometer ranges [3,7-9]; however, those techniques resulted into less stable nanofibers with lower mechanical properties. Stabilization and carbonization processes have potential to behave nanofibers with full mechanical strength attained from the true C=C bonds. The stabilization process of PAN fibers is critical in order to fabricate high-quality carbon fibers [10]. In stabilization, the precursor PAN fibers are heated to a temperature of around 300 °C, during which some chemical reactions such as cyclization, dehydrogenation, aromatization, oxidation and cross-linking occur as a result of the conversion of C≡C bonds to C=C bonds and the formation of a fully aromatic cyclized ladder-like structure [3,11-13].

The new ladder-like structure is thermally stable due to its thermosetting characteristic and during stabilization, CH_2 and CN groups disappear while C=C, C=N and =C-H groups are formed [3]. The stabilization or oxidation process is intended to obviate melting or fusion of PAN fiber and to suppress the excessive volatilization of carbon in the carbonization process [14]. Stabilized PAN fibers generally contained approximately 50 to 60 % carbon by weight. Oxidized PAN fibers results in higher carbon yield of high-performance carbon fibers since they have an aromatic feature, thus obviating the carbon backbone chain from excessive splitting [14]. In the subsequent process of carbonization, the non-carbon elements such as H_2O, HCN, NH_3, CO, CO_2, and N_2 are removed as volatiles, when the stabilized PAN fibers are heat treated at 400 to 1400 °C in an inert atmosphere (argon gas) [3,14]. After carbonization, the PAN- carbonized

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Atypical Presentation of Giant Cell Arteritis with Stroke

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ORIGINAL ARTICLE

Hydromagnetic Falkner-Skan flow of Casson fluid past a moving wedge with heat transfer

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KEYWORDS

Casson fluid;
Moving wedge;
Viscous dissipation;
Heat generation/absorption

Abstract Numerical solutions are carried out for steady state two dimensional electrically conducting mixed convection flow of Casson fluid along non-isothermal moving wedge through porous medium in the presence of viscous dissipation and heat generation/absorption. The governing partial differential equations, subject to boundary conditions are transformed into ordinary differential equations using similarity transformations. The transformed equations are then solved numerically by Keller-box method. To check the validity of present method, numerical results for dimensionless local skin friction coefficient and rate of heat transfer are compared with results of available literature as special cases and revealed in good agreement. The influence of pertinent parameters on velocity, temperature profiles, as well as wall shear stress and heat transfer rate is displayed in graphical form and discussed. It is found that fluid velocity increases with increase of Eckert number in case of assisting flow, while it decreases in case of opposing flow. It is also noticed that heat generation/absorption parameter influence fluid velocity and temperature significantly. A significant result obtained from this study is that heat transfer rate reduces with increase of Prandtl number in the presence of viscous dissipation effect. Also, increasing values of Eckert number have no effects on force convection flow.

1. Introduction

The study of the flow field in a boundary adjacent to the wedge is very important, and is an essential part in the area of fluid dynamics and heat transfer. Especially, convectional flow of Newtonian and non-Newtonian fluid over the wedge becomes important currently. The pioneer work of Falkner-Skan [1] has been extended by Rajagopal et al. [2] to second grade fluid over wedge placed static inside the fluid. Later, Lin and Lin [3] explored the characteristics of heat transfer in force convection flow past a static wedge for any Prandtl number. Watanabe [4] and Pop and Watanabe [5] investigated force and free convection boundary layer flow past a wedge, respectively. Motivated by this, Kumari et al. [6] theoretically investigated mixed convection flow over a wedge saturated in a porous medium under the influence of magnetic field. Chamkha et al. [7] examined the effects of thermal radiation on force convection along non-isothermal wedge.

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ORIGINAL ARTICLE

New version of Optimal Homotopy Asymptotic Method for the solution of nonlinear boundary value problems in finite and infinite intervals

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KEYWORDS

Initial guess;
Auxiliary parameters;
Auxiliary functions;
Galerkin's method;
Embedding parameter;
Optimal Homotopy Asymptotic Method;
New version of Optimal Homotopy Asymptotic Method

Abstract In this research work a new version of Optimal Homotopy Asymptotic Method is applied to solve nonlinear boundary value problems (BVPs) in finite and infinite intervals. It comprises of initial guess, auxiliary functions (containing unknown convergence controlling parameters) and a homotopy. The said method is applied to solve nonlinear Riccati equations and nonlinear BVP of order two for thin film flow of a third grade fluid on a moving belt. It is also used to solve nonlinear BVP of order three achieved by Mostafa et al. for Hydro-magnetic boundary layer and micro-polar fluid flow over a stretching surface embedded in a non-Darcian porous medium with radiation. The obtained results are compared with the existing results of Runge-Kutta (RK-4) and Optimal Homotopy Asymptotic Method (OHAM-1). The outcomes achieved by this method are in excellent concurrence with the exact solution and hence it is proved that this method is easy and effective.

1. Introduction

Various physical models in Engineering and Science can be formulated in terms of boundary value problems (BVPs). These are used in the mathematical modeling of different entities such as visco-elastic flows, hydrodynamic stability problems, non-Newtonian fluids, and convection of heat [1].

Nonlinear BVPs have numerous applications in almost every field of Science and Engineering. Applications of first and second order BVPs can be found in many books at undergraduate level. First order BVPs are applied in fluid dynamics e.g. in design of containers and funnels. It can be applied in heat conduction analysis like design of heat spreaders in micro electronics and it can also be used in combined heat conduction and convection e.g. design of heating and cooling chambers. Second-order BVPs have a variety of applications in Science and Engineering like the vibration of spring and

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Research Article

Nasir Rehman*, Sultan Hussain and Wasim Ul-Haq

Sensitivity analysis of the optimal exercise boundary of the American put option

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Abstract: We consider the American put problem in a general one-dimensional diffusion model. The risk-free interest rate is constant, and volatility is assumed to be a function of time and stock price. We use the well-known parabolic obstacle problem and establish the continuity estimate of the optional exercise boundaries of the American put option with respect to the local volatilities, which may be considered as a generalization of the Achdou results [1].

Keywords: American put option, parabolic obstacle problem, optimal exercise boundary, value function, stochastic volatility

MSC 2010: 60G40, 60G48, 91B28

1 Introduction

Consider the probability space $(\Omega, \mathcal{F}, P)$ and on it an one-dimensional standard Brownian motion (W_t), $0 \le t \le T$. We denote by $(\mathcal{F}_t)$, $0 \le t \le T$, the P-completion of the natural filtration of (W_t), $0 \le t \le T$. Throughout the paper we assume that the time horizon T is finite.

On the filtered probability space $(\Omega, \mathcal{F}, \mathcal{F}_t, P)$, $0 \le t \le T$, we consider a financial market with two assets (S_t^0, S_t), $0 \le t \le T$, where S_t^0, $0 \le t \le T$, is a risk-free asset whose price at time t is given by

$$S_t^0 = e^{rt}, \quad 0 \le t \le T,$$

where $r > 0$ is a risk-free interest rate. The second asset S_t, $0 \le t \le T$, is risky and its evolution obeys the stochastic differential equation

$$dS_t = S_t(r dt + \eta(t, S_t) dW_t), \quad 0 \le t \le T,\ S_0 > 0,$$

where $\eta(t, x)$ is the local volatility function that satisfies the conditions

$$0 < \underline{\eta} \le \eta(t, x) \le \overline{\eta}, \quad 0 \le t \le T,\ x > 0,$$

and

$$|\eta(t, x) - \eta(t, y)| \le C|x - y|$$

for some arbitrary constant C.

We will need the same stochastic differential equation with an arbitrary initial condition, i.e.,

$$dS_u(t, x) = S_u(t, x)\big[r du + \eta(u, S_u(t, x)) dW_u\big], \quad t \le u \le T,\ S_t(t, x) = x > 0. \tag{1.1}$$

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CASE REPORT

Eosinophilic Granuloma in Jaw Bone: A Pare Pediatric Case Report

Karthiga Kannan[1], Naif Alwithanani[2], Mohamed Salama[2], Manoj Kumar[3], Roshan Uthappa[4], Mazood Ahamed[2]

ABSTRACT

BACKGROUND: Eosinophilic granuloma (EG), one of the three clinical forms of Langerhans cell histiocytosis (LCH), is a benign inflammatory reaction to an unknown etiologic agent. It most commonly occurs in children and young adults. The most frequently involved bones are the skull, the ribs and the femurs. Alongside the cranium, the maxilla and mandible can also be affected.

CASE DETAILS: Herein, we report a case of eosinophilic granuloma in a ten years old boy involving posterior quadrants upper and lower jaws as a destructive lesion involving gingiva, periodontium and alveolar bone. Involvement of other bones is ruled out by nucleotide imaging study.

CONCLUSION: EG should be considered as a differential diagnosis whenever there is a bony destructive lesion involving alveolar bone of the Jaws. Early diagnosis and surgical intervention will resolve the lesion.

KEYWORDS: Eosinophilic granuloma, langerhans cell histiocytosis, oral manifestations, alveolar bone and surgical curettage

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INTRODUCTION

Langerhans cell histiocytosis (LCH) is a rare disease characterized by intense and abnormal proliferation of bone marrow-derived histiocytes (Langerhans cells) (1) . **Lichtenstein** classified LCH into three clinical forms depending on the age of the patient when the lesions first appear and their distribution: 1) Chronic focal LCH (**eosinophilic granuloma**) the most frequent and benign of the clinical forms which appears as a uni- or multifocal lesion in a single or various bones with or without soft tissue involvement, without systemic involvement and presenting at any age, 2) Chronic diffuse LCH (**Hand-Schüller-Christian disease**) which usually appears in children or young adults with the characteristic triad of exophthalmos, osteolytic lesions of the cranium and diabetes insipidus. Acute disseminated LCH (**Letterer-Siwe disease**) affects children under three years old involving multiple organs and systems such as liver, lung, lymph nodes, skin, bone and bone marrow and has a fatal outcome in a short time (2,3,4).

In the majority of the cases, oral manifestations may be the first sign of LCH, and on some occasions, the oral cavity may be the only area affected. Therefore, the initial diagnosis in many cases is made by the odontologist (5). To establish an accurate diagnosis, apart from radiographic examination, these lesions should be biopsied. With curettage or roentgen therapy, the lesions begin to regress in a few weeks and should be completely healed in a few months. Without therapy, regression of the lesions is much slower (6).

CASE REPORT

A ten years old boy reported to the clinic with the complaint of pain in the gums of the mandible and

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ORIGINAL ARTICLE

A Study of Lip Prints among North Maharashtrian Population

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ABSTRACT

Aims and Objectives: Cheiloscopy is a technique of forensic odontology or forensic science which deals with examination of lip traces and furrows. This work aimed to study in detail the lip prints of individuals (males and females) in North Maharashtra (Dhule), to determine the most common pattern and to evaluate the differences in lip prints between males and females.
Subjects and Methods: Lip prints of 496 individuals (326 males and 170 females) were obtained. The lip prints were analyzed using Adobe® Photoshop® software and classified according to the classification given by El Domiaty *et al.* The Z-test (SPSS software version 10.0) was used to test the significant difference between males and females for different types of lip patterns.
Results: Our study was able to establish the uniqueness of lip prints. C pattern was found to be most predominant, which is different from studies done in other areas. This shows that geographic variation does exist in lip prints with respect to the most common pattern. On evaluation of patterns among males and females, it was found that there were differences in upper lip patterns among males (type-H) and females (type-C), whereas they were same in lower lip. Therefore, upper lip patterns can be considered more definitive in sex prediction. Furthermore, the lateral segments showed more sexual dimorphism than the medial segments.
Conclusions: This study established the uniqueness of lip prints. According to this finding, we would suggest the creation of database of a given area or neighborhood, which would act as a guideline or comparative reference in cases which require forensic assistance.

Keywords: Cheiloscopy, lip prints, North Maharashtrian, personal identification

INTRODUCTION

The forensic investigation technique which deals with human identification on the basis of lip traces is known as "Cheiloscopy." "Figura Linearum Labiorum Rubrorum" is the term designated to the wrinkles and grooves present on the zone of transition of lips. The imprint produced by these grooves and ridges is termed as "lip print."[1]

Human identification is of utmost importance in any crime investigation and also in some civil cases. Human identification can be a very difficult process. Approaches for personal identification include anthropometry, fingerprint analysis, DNA fingerprinting, postmortem records, and blood groups differentiation.[1] The most common techniques allowing fast and reliable identification are dental records, fingerprint, and DNA evaluations. However at times, it is necessary to use other techniques like lip prints.[2] Since like fingerprints the lip prints of individuals is also distinctive and hence holds strong prospective for personal identification.[1]

In spite of many studies being done in recent years, no unanimity is seen in the acceptance of cheiloscopy as a valid tool in human identification. This study was done to examine the uniqueness of lip print pattern in a given set of population and to evaluate for differences among male and female patterns. This study also aimed to compare the most prevalent patterns in this population with previous studies done on different sets of population.

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ORIGINAL ARTICLE

Unsteady thin film flow of a fourth grade fluid over a vertical moving and oscillating belt

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KEYWORDS
Unsteady flow;
Thin film;
Lifting and drainage;
Fourth grade fluid;
Adomian decomposition method (ADM);
Optimal homotopy asymptotic method (OHAM)

Abstract This article studies the unsteady thin film flow of a fourth grade fluid over a moving and oscillating vertical belt. The problem is modeled in terms of non-nonlinear partial differential equations with some physical conditions. Both problems of lift and drainage are studied. Two different techniques namely the adomian decomposition method (ADM) and the optimal homotopy asymptotic method (OHAM) are used for finding the analytical solutions. These solutions are compared and found in excellent agreement. For the physical analysis of the problem, graphical results are provided and discussed for various embedded flow parameters.

1. Introduction

Due to the diverse physical structures of non-Newtonian fluids, several constitutive models have been proposed in the literature to predict all of their salient features. Generally, there are three non-Newtonian fluids models. They are known as (i) the differential type, (ii) the rate type, and (iii) the integral type. However, the most famous amongst them are the first two models. In this article, we will study the first model, the differential type fluid also known as grade n fluids and consider its subclass known as the fourth grade fluid. The simplest subclass of differential type is the second grade fluid for which one can reasonably hope to obtain an analytical solution. Although a second grade fluid model also known as grade

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Long-lived K isomer and enhanced γ vibration in the neutron-rich nucleus ^{172}Dy: Collectivity beyond double midshell

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ABSTRACT

The level structure of ^{172}Dy has been investigated for the first time by means of decay spectroscopy following in-flight fission of a ^{238}U beam. A long-lived isomeric state with $T_{1/2} = 0.71(5)$ s and $K^{\pi} = 8^{-}$ has been identified at 1278 keV, which decays to the ground-state and γ-vibrational bands through hindered electromagnetic transitions, as well as to the daughter nucleus ^{172}Ho via allowed

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Characterization of the Adherence of *Clostridium difficile* Spores: The Integrity of the Outermost Layer Affects Adherence Properties of Spores of the Epidemic Strain R20291 to Components of the Intestinal Mucosa

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Clostridium difficile is the causative agent of the most frequently reported nosocomial diarrhea worldwide. The high incidence of recurrent infection is the main clinical challenge of *C. difficile* infections (CDI). Formation of *C. difficile* spores of the epidemic strain R20291 has been shown to be essential for recurrent infection and transmission of the disease in a mouse model. However, the underlying mechanisms of how these spores persist in the colonic environment remains unclear. In this work, we characterized the adherence properties of epidemic R20291 spores to components of the intestinal mucosa, and we assessed the role of the exosporium integrity in the adherence properties by using *cdeC* mutant spores with a defective exosporium layer. Our results showed that spores and vegetative cells of the epidemic R20291 strain adhered at high levels to monolayers of Caco-2 cells and mucin. Transmission electron micrographs of Caco-2 cells demonstrated that the hair-like projections on the surface of R20291 spores are in close proximity with the plasma membrane and microvilli of undifferentiated and differentiated monolayers of Caco-2 cells. Competitive-binding assay in differentiated Caco-2 cells suggests that spore-adherence is mediated by specific binding sites. By using spores of a *cdeC* mutant we demonstrated that the integrity of the exosporium layer determines the affinity of adherence of *C. difficile* spores to Caco-2 cells and mucin. Binding of fibronectin and vitronectin to the spore surface was concentration-dependent, and depending on the concentration, spore-adherence to Caco-2 cells was enhanced. In the presence of an aberrantly-assembled exosporium (*cdeC* spores), binding of

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Public knowledge and attitudes toward epilepsy in Majmaah

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Abstract

Objectives:

Epilepsy is very common in the Kingdom of Saudi Arabia, occurring in 6.54 out of every 1000 individuals. The current study was conducted to determine the level of public awareness of and attitudes toward epilepsy in the city of Majmaah, Saudi Arabia.

Subjects and Methods:

This descriptive study was conducted in Majmaah, Saudi Arabia. The study population included respondents derived from preselected public places in the city. Stratified random sampling was used, and the sample size was made up of 706 individuals. A structured questionnaire was used for data collection from respondents after receiving their verbal consent. The data were analyzed using SPSS version 2.0. Ethical approval was obtained from the Ethics Committee of Majmaah University.

Results:

The results showed that 575 (81.4%) of the respondents had heard or read about epilepsy. Almost 50% of the respondents knew someone who had epilepsy, and 393 (55.7%) had witnessed what they believed to be a seizure. Results showed that 555 (78.6%) respondents believed that epilepsy was neither a contagious disease nor a type of insanity. It was found that 335 (47.5%) stated that epilepsy was a brain disease, and almost one-quarter of the respondents said that the manifestation of an epileptic episode is a convulsion. Regarding attitude, 49% and 47.3% of respondents stated that they would not allow their children to interact with individuals with epilepsy and would object to marrying an individual with epilepsy, respectively.

Conclusion:

Although knowledge about epilepsy is improving, it is still not adequate. The study showed that the attitude toward epilepsy is poor.

Keywords: Attitudes, epilepsy, knowledge, Majmaah, Saudi Arabia, Saudi population

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Assessment of metals in cosmetics commonly used in Saudi Arabia

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Abstract Cosmetics are one of the most important sources of releasing heavy metals. Different varieties of chemicals are used in cosmetic products as ingredients and some are used as preservatives. There are concerns regarding the presence of harmful chemicals in these products. Among the harmful chemicals, cosmetic products contain heavy metals. The present study was conducted to determine the content of certain heavy metals in the products made in different countries and marketed in Saudi Arabia. Thirty-one products of different brands or misbrands of commonly used cosmetic products (hair cream, beauty cream, skin cream, hair food formula, hair gel, whitening daily scrub, shampoo, shower gel, body care, body lotion, hand wash, daily fairness, shaving cream, toothpaste, germ and beauty soap, and cream soap) were purchased from local markets of Saudi Arabia. Samples were analyzed to determine the concentrations of ten metals (lead, aluminum, cadmium, cobalt, chromium, copper, manganese, nickel, mercury, and arsenic) using inductively coupled plasma mass spectrometer (ICP-MS). Based on the maximum concentrations, the heavy metal contents were arranged in the following decreasing order: Al > Cu > Mn > Pb > Cr > Ni > Hg > Co > As > Cd in cream products, Al > Pb > Cu > Cr > Mn > Ni > Hg > As > Co > Cd in shampoo products, Al > Cu > Pb > Cr > Mn > Ni > As > Co > Hg > Cd in soap products, and Al > Cu > Mn > Pb > Cr > Co > Ni > Cd > As > Hg in toothpaste products. Since the metal concentrations may relate to specific brands, product type, color, or cost, industrialist would have to check the raw materials before they are gathered into the final products to track the source of these contaminants.

Keywords Heavy metals · Cosmetics · Trace analysis · Inductively coupled plasma mass spectrometer

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Introduction

Cosmetic products are considered a part of routine body care. There are concerns regarding the presence of harmful chemicals in these products. Among the hazardous substances contained in cosmetic products, heavy metals such as lead, aluminum, cadmium, cobalt, chromium, copper, manganese, nickel, titanium, iron, zinc, mercury, and arsenic. Many investigators studied the heavy metals contents in cosmetic products of different countries (Chauhan et al., 2010; Omolaoye et al., 2010; Al-Dayel et al., 2011; Al-Saleh and Al-Enazi, 2011; Peregrino et al., 2011; Al-Saleh et al., 2009, Adepoju-Bello et al., 2012; Volpe et al., 2012; Al-Qutob et al., 2013; Brown, 2013; Faruruwa and Bartholomew, 2014; Borowska and Brzoska, 2015).

Heavy metals are widely diffused in pigmented make-up products (Sainio et al., 2000). Therefore, cosmetics are one of the most important sources of releasing heavy metals in the environment. Chauhan et al. (2010)

Computational Study of Three-Dimensional Stagnation Point Nanofluid Bioconvection Flow on a Moving Surface With Anisotropic Slip and Thermal Jump Effect

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The effects of anisotropic slip and thermal jump on the three-dimensional stagnation point flow of nanofluid containing microorganisms from a moving surface have been investigated numerically. Anisotropic slip takes place on geometrically striated surfaces and superhydrophobic strips. Zero mass flux of nanoparticles at the surface is applied to achieve practically applicable results. Using appropriate similarity transformations, the transport equations are reduced to a system of nonlinear ordinary differential equations with coupled boundary conditions. Numerical solutions are reported by means of very efficient numerical method provided by the symbolic code Maple. The influences of the emerging parameters on the dimensionless velocity, temperature, nanoparticle volumetric fraction, density of motile microorganism profiles, as well as the local skin friction coefficient, the local Nusselt number, and the local density of the motile microorganisms are displayed graphically and illustrated in detail. The computations demonstrate that the skin friction along the x-axis is enhanced with the velocity slip parameter along the y-axis. The converse response is observed for the dimensionless skin friction along the y-axis. The heat transfer rate is increased with greater velocity slip effects but depressed with the thermal slip parameter. The local Nusselt number is increased with Prandtl number and decreased with the thermophoresis parameter. The local density for motile microorganisms is enhanced with velocity slip parameters and depressed with the bioconvection Lewis number, thermophoresis, and Péclet number. Numerical results are validated where possible with published results and excellent correlation is achieved. [DOI: 10.1115/1.4033581]

Keywords: three-dimensional gyrotactic bio-convection, anisotropic slip, microrganisms, thermal jump, zero mass flux

1 Introduction

Stagnation point flow arises whenever a flow impinges onto a solid object and is of relevance, for example, in turbomachinery, polymer extrusion, wake aerodynamics, continuous casting of metals, glass blowing, etc. [1,2]. Various aspects of stagnation point flow have been investigated by many authors [3–5]. Another important development in fluid mechanics over the past decade has been *microfluidics* [6] which has presented new problems in computing and measuring slip phenomena in fluid motion. A successful approach in simulating such flows is the adoption of an effective slip boundary condition, which can be constructed using an anisotropic formulation. This has been found to mimic actual boundary conditions in real systems [6]. A number of investigators [7–9] have studied slip boundary conditions for various transport problems.

Applications of conventional fluids (e.g., oil, water, organic-based fluid, mineral liquids, lubricants, biofluids, polymeric solution) as a cooling tool increase manufacturing and operating costs due to their poor conductivity. Heat transfer rates can be improved by (i) active and (ii) passive techniques (e.g., geometry modification (micro/nanochannels), special surface geometries, surface roughness, suction/injection of fluid, fluid motion, fluid additives (ultrafine nanoparticles) [10]. Choi [11] investigated the doping with ultrafine nanoparticles dispersed in the base fluid and thereby introduced *nanofluids*. Nanofluid transport phenomena have subsequently received substantial attention since such fluids can benefit many industrial and medical systems including optics, coatings, ceramics, drug delivery, propulsion, and electronics. Mathematical models of nanofluid behavior are also garnering great interest. Buongiorno [12] proposed a model in which the Brownian diffusion and thermophoresis effects are emphasized. Kuznetsov and Nield [13] employed Buongiorno's model to derive similarity solutions for natural convective flow.

A parallel development in convection flows has been the emergence of *bioconvection fluid mechanics*. Microorganisms are able to modify their environment by bioconvection [14]. Intrinsic to this phenomenon is the enhancement in densities of the neighboring fluids owing to the swimming of microorganisms which generate bioconvective currents. The resultant large-scale fluid motion increases mixing as well as nutrient supply. Bioconvection is also of interest in the design of microfluidic/nanofluidic devices. In such devices, the mixing of small microorganisms with fluids is often insufficient [15]. Patterns are generated by swimming cells with inherently random orientations which respond to specific stimuli—this induces migration toward more favorable locations. These responses are known as *taxes* and may be *phototaxis* (migration toward or away from light)—akin to phototropisms in botany, *gravitaxis* (relocation toward gravity) and *gyrotaxis* (a balance between a gravitational torque in which the microorganisms are bottom heavy and viscous torques). In micro/nanodevices, the active mixers are used to enhance the mixing, although they are quite expensive and energy intensive in fabrication. In addition, they might damage the biological samples due to the Joule heating produced [16]. As state-of-the-art fluids, nanofluids are now being implemented in the synthesis of novel microfluidics/nanofluidics devices in which bioconvection plays a vital role. Since bioconvection in nanofluids has potential for increasing mass transfer and inducing mixing of small particles

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Ultrasonic relaxation of some CdO boro-tellurate glasses

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ABSTRACT:

50 B_2O_3 – (50-x) TeO_2 – x CdO glass system, with x = 0, 10, 20, 30, 40 and 50 mol % have been prepared, to measure the longitudinal ultrasonic attenuation at frequencies of 2, 4, 6 and 14 MHz in the temperature range from 120 to 300 K. Well-defined broad peaks of the absorption curves were observed at different temperatures depending on the glass composition and the operating frequency. The maximum peaks shifted to higher temperatures with the increase of the operating frequency implying the presence of some kind of relaxation process. This process suggested as due to the thermally activated relaxation process. The variation of the average activation energy of the process is mainly depending on CdO mol % content. Such dependence, was analyzed in terms of the loss of standard linear solid type, with low dispersion and a broad distribution of Arrhenius type relaxation with temperature independent relaxation strength. The obtained acoustic activation energy values were quantitatively, interpreted in terms of the number of loss centers (number of oxygen atoms that vibrate in the double well potential).

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The impact silver nanoparticles on MHD free convection flow of Jeffrey fluid over an oscillating vertical plate embedded in a porous medium

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ABSTRACT

This article studies the influence of copper nanoparticles (CuNPs) and silver nanoparticles (AgNPs) on the unsteady magnetohydrodynamic (MHD) free convection flow of Jeffrey fluid over an oscillating vertical plate embedded in a saturated porous medium. Nanoparticles (CuNPs and AgNPs) are suspended in Kerosene oil which is chosen as a conventional base fluid. Appropriate dimensionless variables are employed to the governing equations and the exact solutions are obtained for velocity and temperature fields using the Laplace transform technique. The results for various controlling parameters for both CuNPs and AgNPs are shown graphically and discussed in details. Expressions for skin friction and Nusselt number are also evaluated and presented in tabular forms. It has been observed that, an increase of volume fraction leads to the enhancement of velocity and temperature distributions. On the other hand, Hartmann number tends to resist the fluid flow due to the Lorentz force. A comparative study of the present results with the results from the earlier works provides an excellent agreement.

1. Introduction

Conventional heat transfer fluids such as ethylene glycol (EG), water, lubricant oil and kerosene oil are found to have limited heat transfer capabilities due to their low thermal conductivities compared to metals. In his pioneering work, Choi [1] introduced a sart fluid or so called nanofluids, refers to a mixture of nanoparticles (having diameter 1–100 nm) and ordinary base fluids. He found that adding nanoparticles to the base fluid increase its thermal conductivity and leads to an enhancement of the heat transfer. He further noticed that nanofluids are more stable and do not have additional problems such as sedimentation, erosion and additional pressure drop due to the tiny size of nano-particles and low volume fraction of nanoparticles is required for conductivity enhancement. After Choi, many researchers studied nanofluids for thermal conductivity enhancement from both experimental and theoretical aspects including Rashidi et al. [2] , Eastman et al. [3], Lee et al. [4], Eastman et al. [5], Das et al. [6] and Murshed et al. [7], Buongiorno [8], Dinarvand et al. ([9–12]) Sandeep et al. [13], Loganathan et al. [14], Rajesh et al. [15], Turkyilmazoglu and Pop [16], Turkyilmazoglu [17], Das and Jana [18], Mohyud-Din et al. ([19,20]), Kataria and Mittal [22] and Khan et al. [21].

Besides that the study of porous medium with heat transfer has stimulated increase recently owing to the rapidly development in many industrial applications used as a transport and store energy in heat pipe, solid matrix heat exchanges, electronic cooling and chemical reactors [22]. Porous medium means a material consisting of a solid matrix with interconnected voids [23]. Hussanan et al. [24] focused on theoretical aspects of unsteady MHD free convection flow of some nanofluids past an accelerating infinite vertical plate in a porous medium and solved the problem analytically using the Laplace transform. Few other attempts in this direction are made by Satya Narayana et al. [25], Aaiza et al. [26] and Khan et al. [27].

Amongst the various models of non-Newtonian fluids, Jeffrey model is accorded as a relatively simpler linear model where time derivatives are used instead of convective derivatives. Due to this reason, several investigations on Jeffrey fluid were carried out in the last few years in the presence and absence of nanoparticles, see for examples ([28–40]) and the references therein.

From the best of our knowledge, most of the Jeffrey nanofluid investigations are highlighted on the slip mechanisms of Brownian diffusion and thermophoresis effects based on Buongiorno model [8]. However, there is no study that has been reported for unsteady Jeffrey nanofluid following the Tiwari and Das model [41] where it is focused on the nanoparticles of volumetric fraction. Motivated by the above literature, the aim of the present study is to conduct an analytical study for unsteady free convection flow of Jeffrey nanofluids saturated in a porous medium over an infinite oscillating vertical flat plate. Kerosene oil as conventional based Jeffrey nanofluid is used with two types of nanoparticles namely Cu and Ag are considered. Suitable dimensionless

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Forced convection of nanofluid flow across horizontal circular cylinder with convective boundary condition

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ABSTRACT

A numerical investigation has been conducted to investigate the steady forced convection boundary layer nanofluid flow past a horizontal circular cylinder placed in water-based copper (Cu) and alumina (Al_2O_3) nanofluids. Using appropriate transformations, the system of partial differential equations is converted into an ordinary differential system of three equations, which is solved numerically using Keller box and Newton-Raphson methods. The effects of thermal and solutal convective boundary conditions are taken into account which makes the present analysis practically applicable. Numerical results are obtained for the dimensionless velocity, temperature and concentration as well as the skin-friction, Nusselt and Sherwood numbers for specific values of the governing parameters with fixed Prandtl number ($Pr = 6.2$) and Schmidt number ($Sc = 0.68$) for water. It is shown that, for a regular fluid ($\phi = 0$), a very good agreement exists between the present numerical results and those reported in open literature.

1. Introduction

Over the decades, meticulous research efforts have been given for broad understanding of the fluid flow, heat and mass transfer across various geometries. To be specific, forced convection heat transfer across isothermal or isoflux surfaces is an important problem for engineers. Several engineering systems are modeled using forced convection, such as electronic components, hot wire anemometer, and heat exchangers [1]. The details of the boundary layer theory and forced convection across circular cylinder could be found in books [2,3] and in literature [4–10]. Mixed convection from a horizontal circular cylinder has been studied by [11–14] whereas free convection has been studied by [15,16] among others. Recently, Salleh and coworkers [17,18] have investigated forced convection boundary layer flow across a horizontal circular cylinder with Newtonian heating boundary condition.

In recent years, as energy costs have escalated rapidly, there has been a great need for new kinds of heating/cooling fluids that will increase thermal efficiency and thus reduce overall energy consumption. Choi [19] was the first who introduced the theory of nanofluid, since then it has been an active field of research for about two decades. Nanofluids have attracted attention as a new generation of coolant for various industrial and automotive applications because of their excellent thermal performance [20]. Nanofluids are the dispersions of nanometer-sized particles (<100 nm) in a base fluid such as water, ethylene glycol, or propylene glycol. The use of high thermal conductivity metallic nanoparticles (*e.g.*, copper, aluminum, silver, titanium oxide) has the effect of increasing the thermal conductivity of such mixtures, thus enhancing their overall energy transport capability [21]. Nanofluids offer many diverse advantages in industrial applications such as macro [22] and microscale heat exchangers [23], biomedicine and transportation, fuel cell, nuclear reactors [24].

Only few studies on heat transfer of nanofluids past a circular cylinder in cross flow are available in literature. Sarkar et al. [25] investigated the mixed convective flow and heat transfer characteristics of water-based nanofluids past a circular cylinder in cross flow. They found that an increase in solid volume fraction show reduction in thermal boundary layer thickness and that the local and average Nusselt numbers increase with increasing solid volume fraction of nanoparticles. Prasad et al. [26] investigated numerically the free-convection flow, heat, and mass of a non-Newtonian nanofluid from a horizontal circular cylinder to a micropolar fluid. Their model is useful in energy systems and the thermal enhancement of industrial flow processes. Ashorynejad et al. [27] and Gorla et al. [28] studied the flow and heat transfer of a nanofluid over a stretching cylinder in the presence of magnetic field. They found that the Nusselt number increases with an increase in the Reynolds number and nanoparticles volume fraction, but it decreases as magnetic parameter increase. Tham et al. [29] studied the steady mixed convection boundary layer flow of a nanofluid past a horizontal circular cylinder in a stream flowing vertically upwards for both cases of a heated and cooled cylinder. They found that the skin friction

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Bosonic Lasing from Collective Exciton Magnetic Polarons in Diluted Magnetic Nanowires and Nanobelts

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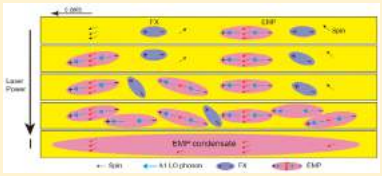
Supporting Information

ABSTRACT: Exciton magnetic polarons (EMPs) are self-organized magnetic quasiparticles that can be formed by excitons in diluted magnetic semiconductors (DMSs). The optical response of EMPs in DMS microstructures is not yet well understood because it is affected by many competing factors, including spin-dependent exchange interactions, phonon coupling, and collective and nonlinear effects upon the dopant concentration and structural relaxation. Here, we report on lasing from collective EMP states in Co(II)-doped CdS nanowires (NWs) and nanobelts (NBs) that we interpret in terms of bosonic lasing, the spontaneous emission of radiation by a single quantum state macroscopically populated by bosonic quasiparticles. The lasing threshold coincides with the appearance of ferromagnetic domains, indicating an important role of spin ordering in the formation of coherent collective EMPs. These results pave the way to the realization of a new type of bosonic laser, different from exciton-polariton lasers, where formation of the bosonic condensate is possible due to the coupling of EMPs via the exchange interaction of exciton and magnetic ion spins.



KEYWORDS: *exciton magnetic polarons, lasing, nanobelts and nanowires, diluted magnetic semiconductors*

Carrier-spin interactions are generally considered as the source of ferromagnetism in narrow-bandgap diluted magnetic semiconductors (DMS).[1,2] In wide-bandgap DMS, the transition metal (TM) ions can arrange their spins ferromagnetically if sufficient concentrations of spin-polarized carriers or excitons are present. The exchange interaction between carrier (exciton) spins and spins of magnetic ions is responsible for the magnetic polaron effect manifested by the self-trapping of carriers or excitons and formation of small ferromagnetic domains. Magnetic polaron formation strongly affects the optical properties of DMS. Most bulk DMS crystals do not exhibit a strong photoluminescence (PL) signal in the case of heavy doping. Low-dimensional structures, including quantum dots (QDs) and quantum wells (QWs), are usually better light emitters than bulk crystals. In DMS QDs, the impurity ions and photoinduced excitons may couple to each other, forming exciton magnetic polarons (EMPs), which are manifested in PL spectra as strong resonances near the band-edge.[3−5] EMPs localized at the static disorder fluctuations have also been observed in QW structures.[6] The magnetic polaron effect is likely to be responsible for light-induced ferromagnetism in colloidal QDs.[7] The ferromagnetic alignment of the localized magnetic ions in the vicinity of a carrier or an exciton is at the origin of this effect.[8] The signatures of EMPs in DMS QWs and bulk crystals are peaks at the lower energy side of free exciton (FX) emission lines. The red-shift of EMP lines compared to FX lines is due to the exchange interaction of TM ion spins with spins of excitons.[9,10] EMP spectral lines are usually subject to a strong inhomogeneous broadening caused by the fluctuations in the concentration of impurity ions. Coupled localized EMPs (LEMPs) in bulk DMS form clusters that can generate coherent spin-polarized emission at high excitation densities.[11,12]

Here, we study diluted magnetic Co(II)-doped CdS nanowires (NWs) and nanobelts (NBs), where a very strong and broad emission band can be observed at approximately 540−800 nm. This band is caused by the $^4T_1(P) \rightarrow {}^4A_2(F)$ transition of Co^{2+} ions next to its band-edge emission at above-critical concentrations of the dopant ions. The temperature dependence of the emission of these structures appears to be correlated to their magnetic response, up to 373 K. The band-edge emission can be divided into two bands composed of the individual free exciton (FX) band and the EMP band at low

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ORIGINAL PAPER

Influence of Na Addition on Magnetic and Magnetocaloric Effects of $La_{0.67}Pb_{0.13}Na_{0.2}MnO_3$ Ceramics

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Abstract Structural, magnetic, magnetocaloric, and electrical properties are reported for mixed-valence manganite $La_{0.67}Pb_{0.13}Na_{0.2}MnO_3$. X-ray diffraction reveals that the sample crystallizes in the rhombohedric structure with the R-3c space group. The magnetic properties of the polycrystalline $La_{0.67}Pb_{0.13}Na_{0.2}MnO_3$ compound are discussed in detail, based on the susceptibility, magnetization, and isotherm. The sample presents a ferromagnetic property with $T_C = 275$ K and a Griffiths phase at $T_G = 325$ K which gives the existence of ferromagnetic clusters in the paramagnetic domain. A large deviation is usually observed between field cooled (FC) and zero field cooled (ZFC). $M(T)$ is a low temperature below the blocking temperature. At 40 K, a spin-glass or a cluster-glass state is seen to arise from a ferromagnetic state. This is caused by the competition between the antiferromagnetic and ferromagnetic interactions. The electrical properties show the presence of a metal–semiconductor transition at T_{M-Sc}. To understand the dependence of disorder with the transport mechanism, we used the phenomenological equation for resistivity under a percolation approach, which is dependent on the phase segregation of a paramagnetic semiconductor and ferromagnetic metallic regions.

Keywords Na-doped manganites · Griffiths phase · Magnetocaloric effect · Electrical transport

1 Introduction

Perovskite manganites constitute an extremely interesting class of compounds with fascinating structural and physical properties related to chemical composition. These manganites manifest a very high value of a colossal magnetoresistive (CMR) effect, which can be utilized in the highly sensitive sensors of the magnetic field [1]. Many factors affect the magnetic and transport properties such as the average ionic radius of the A site that may couple with the Mn ions, the magnetic moment of the rare earth ions, and the doping concentration x which determines the Mn^{4+}/Mn^{3+} ratio. Recently, perovskite manganites are also expected to be promising candidates for magnetic refrigeration technology [2]. The parent compound $LaMnO_3$ is an insulating material with antiferromagnetic ordering at low temperatures. The partial substitution of the trivalent La^{3+} ion by the divalent M^{2+} ion in $LaMnO_3$ gives rise to the coexistence of Mn^{4+} ($3d^3, t_{2g}^3 \uparrow e_g^0$, $S = 3/2$) and Mn^{3+} ($3d^4, t_{2g}^3 \uparrow e_g^1 \uparrow$, $S = 2$) ions and controls the Mn^{4+}/Mn^{3+} ratio, out of which the e_g electrons can be delocalized. This shows that the substitution at the La site does ultimately affect the Mn site ion in the $La_{1-x}M_xMnO_3$ perovskite structure. Transfer of itinerant e_g electrons between neighboring Mn^{3+} and Mn^{4+} ions through O^{2-} ions, in accordance with the Zener double exchange model [3], results in ferromagnetic interaction due to the on-site Hund's coupling. Recently, it has

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PLOS ONE

RESEARCH ARTICLE

Unsteady MHD Mixed Convection Slip Flow of Casson Fluid over Nonlinearly Stretching Sheet Embedded in a Porous Medium with Chemical Reaction, Thermal Radiation, Heat Generation/Absorption and Convective Boundary Conditions

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Abstract

Numerical results are presented for the effect of first order chemical reaction and thermal radiation on mixed convection flow of Casson fluid in the presence of magnetic field. The flow is generated due to unsteady nonlinearly stretching sheet placed inside a porous medium. Convective conditions on wall temperature and wall concentration are also employed in the investigation. The governing partial differential equations are converted to ordinary differential equations using suitable transformations and then solved numerically via Keller-box method. It is noticed that fluid velocity rises with increase in radiation parameter in the case of assisting flow and is opposite in the case of opposing fluid while radiation parameter has no effect on fluid velocity in the forced convection. It is also seen that fluid velocity and concentration enhances in the case of generative chemical reaction whereas both profiles reduces in the case of destructive chemical reaction. Further, increase in local unsteadiness parameter reduces fluid velocity, temperature and concentration. Over all the effects of physical parameters on fluid velocity, temperature and concentration distribution as well as on the wall shear stress, heat and mass transfer rates are discussed in detail.

Introduction

Boundary layer flow over a stretching surface has several engineering and industrial applications, for example, in cooling bath, Aerodynamic extrusion, plastic sheet, metallurgical process, glass blowing, manufacturing of rubber and plastic sheets, crystal growing, the sheets are continuously stretched. During manufacturing, sheets are stretched continuously in order to achieve the desired thickness. It shows that final product depends upon the stretching and

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THE EUROPEAN PHYSICAL JOURNAL PLUS

Regular Article

Application of Caputo-Fabrizio derivatives to MHD free convection flow of generalized Walters'-B fluid model

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Abstract. The present article applies the idea of Caputo-Fabrizio time fractional derivatives to magnetohydrodynamics (MHD) free convection flow of generalized Walters'-B fluid over a static vertical plate. Free convection is caused due to combined gradients of temperature and concentration. Hence, heat and mass transfers are considered together. The fractional model of Walters'-B fluid is used in the mathematical formulation of the problem. The problem is solved via the Laplace transform method. Exact solutions for velocity, temperature and concentration are obtained. The physical quantities of interest are examined through plots for various values of fractional parameter: α, Walters'-B parameter Γ, magnetic parameter M, Prandtl number Pr, Schmidt number Sc, thermal Grashof number Gr and mass Grashof number Gm. As a special case, the published results from open literature are recovered.

1 Introduction

In recent times, non-Newtonian fluid dynamics has been the subject of great concern not only to fluid researchers but also to other investigators. Most of the biological and industrial fluids, such as polymers, paints, liquid detergents, multi-grade oils, greases, coolants, blood, printer inks, etc., do not follow the classical Newton's law of viscosity and are termed as non-Newtonian. Researchers have proposed a variety of mathematical models to understand the dynamics of such fluids [1–5]. Among them, viscoelastic fluids are popular as they arise in numerous processes in chemical engineering systems. Such fluids possess both viscous and elastic properties and can exhibit normal stresses and relaxation effects. Walters [6] has proposed a classic model for the rheological equation of viscoelastic fluids. This model perhaps is the most widely discussed viscoelastic fluid model which can accurately simulate the complex flow behavior of many industrial liquids, such as polymer solutions, hydrocarbons and paints. The Walters'-B model generates highly non-linear equations and they cannot be easily handled, like classical Navier-Stokes equations describe the Newtonian fluid flow. The extensional polymer's behavior and its elastic properties are also introduced by this model. For some important attempts studying the Walters'-B fluid model, the reader is referred to [7–16] and the references therein. However, all these studies were focussed on ordinary derivatives and modelling of Walters'-B fluid. From a detailed survey of the literature, it is found that no study has been reported on the fractional model of Walters'-B fluid, also known as generalized model of Walters'-B fluid. Therefore, in this research the fractional model of Walters'-B fluid has been chosen to study heat and mass transfer over a static vertical plate.

In fluid dynamics, fractional derivatives models were studied in the past for viscoelastic materials, such as glassy state and polymers [17]. The commonly used fractional models are the Riemann-Liouville fractional derivative, the Caputo fractional derivatives, the Caputo-Fabrizio derivatives and the Atangana-Baleanu fractional derivatives [18–26]. The Riemann-Liouville fractional derivative of a constant term is not zero and the Laplace transform of this derivatives contains insignificant physical terms. The Caputo fractional derivative has overcome these difficulties but the kernel of the definition is a singular function. Recently, Caputo and Fabrizio and Atangana and Baleanu have introduced new definitions without singularities and with an exponential kernel [20, 23]. The Caputo-Fabrizio and Atangana-Baleanu models are suitable to use the Laplace transform. For several existing fluid models, fractional derivatives models have been developed [27–30]. Hayat *et al.* [31] investigated the periodic viscoelastic flows with the fractional Maxwell model. Qi and Xu [32] considered the unsteady channel flow of a viscoelastic fluid with the fractional Maxwell

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MHD flow of water-based Brinkman type nanofluid over a vertical plate embedded in a porous medium with variable surface velocity, temperature and concentration

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ABSTRACT

The aim of this paper is to investigate the unsteady magnetohydrodynamic (MHD) flow of Brinkman type nanofluid over a vertical plate embedded in a porous medium with variable surface velocity, temperature and concentration. The thermal radiation effect in the energy equation and chemical reaction in the concentration are also considered. Four different types of nanoparticles of spherical shape namely Silver (Ag), Copper (Cu), Titanium oxide (TiO_2) and Aluminum oxide (Al_2O_3) are suspended in water taken as conventional base fluid. The problem is modeled in terms of partial differential equations with physical boundary conditions. Closed form solutions are obtained for velocity, temperature and concentration, using the Laplace transform technique. Graphical results for different physical parameters such as Brinkman parameter, volume fraction and radiation parameter are presented. Corresponding expressions for skin-friction, Nusselt number and Sherwood number are also evaluated. The present solutions are reduced to some well-known results in the published literature and are found in an excellent agreement.

1. Introduction

Non-Newtonian fluids have enormous applications in industries such as chemical, pharmaceutical and cosmetics [1,2]. Due to their wide range of applications in science and technology, researchers are always attracted toward these types of fluids. There are various models that have been suggested in literature for non-Newtonian fluids. One of them is called Brinkman type fluid. This model was proposed by Darcy for the fluid past low porous surfaces [3]. More exactly, this model is applicable for the flow over a body with low porosity. Flow over a body with high porous surfaces does not obey Darcy's law. Brinkman proposed a model for fluids over high permeable surfaces [4,5]. An incompressible viscous fluid that shows a flow over a high permeable media is called Brinkman type fluid. Very few studies have been done in this regard, using Brinkman type fluid. Particularly, convective flows of Brinkman type fluid with heat and mass transfer are less investigated, although such studies have plenty applications in industries [6–10].

Low thermal conductivity of convective heat transfer fluids such as (EG) ethylene glycol, water and oil mixture have a serious limitation in improving the compactness and performance of many engineering equipment such as heat exchangers and electronic devices. To get rid of these difficulties, there is a strong provocation to develop innovative heat transfer fluid with extensively higher thermal conductivity. Therefore, several methods have been suggested to improve the thermal conductivity of this fluid by suspending nano/micro or large size particles in liquids [11]. However, the first successful attempt in this direction was made by Choi [12]. He introduced an innovative technique to improve heat transfer by using nano scaled particles (less than 100 nm) in the base fluid. These nanoparticles are typically made up of metals (Al, Cu), oxides, and nitrides because of their highly thermal conductivities. Nanoparticles also have special acoustical properties in ultrasonic field display, additional shear wave, reconversion of an incident compressional wave [13]. Some useful results obtained by famous researchers for the flow of nanofluids can be found in [14–21]. However, most of the existing literature on nanofluids is limited to either experimental or numerical studies. The first exact solution of nanofluids was obtained by Loganathan et al. [22] for unsteady free convection flow of nanofluids with radiation effects. Seth et al. [23], investigated the unsteady hydrodynamic radiative flow of nanofluids with ramped temperature. Akbar et al. [24] examined radiation effects on MHD stagnation point flow of nanofluids toward a stretching surface with convective boundary condition. Furthermore, Hady et al. [25] investigated heat transfer and radiation on viscous flow with nanofluids over non-linear stretching sheet. Anwar et al. [26], discussed the conjugate effect of heat and mass transfer of nanofluids over a non linear stretching sheet. Sheikholeslami and Ganji [27], discussed three dimensional heat and mass transfer in a

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Characterization of germinants and their receptors for spores of non-food-borne *Clostridium perfringens* strain F4969

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Clostridium perfringens type A can cause both food poisoning (FP) and non-food-borne (NFB) gastrointestinal diseases. Our previous study reported that a mixture of L-asparagine and KCl (AK)-germinated spores of FP and NFB isolates well, but KCl and, to a lesser extent, L-asparagine induced spore germination only in FP isolates. We now report that the germination response of FP and NFB spores differsignificantly in several defined germinants and rich media. Spores of NFB strain F4969 *gerAA*, *gerKA-KC* or *gerKC* mutants lacking specific germinant receptor proteins germinated more slowly than wild-type spores with rich media, did not germinate with AK and germinated poorly compared to wild-type spores with L-cysteine. The germination defects in the *gerKA-KC* spores were largely due to loss of GerKC as (i) *gerKA* spores germinated significantly with all tested germinants, while *gerKC* spores exhibited poor or no germination; and (ii) germination defects in *gerKC* spores were largely restored by expressing the wild-type *gerKA-KC* operon *in trans*. We also found that *gerKA-KC*, *gerAA* and *gerKC* spores, but not *gerKA* spores, released dipicolinic acid at a slower rate than wild-type spores with AK. The colony-forming efficiency of F4969 *gerKC* spores was also ~35-fold lower than that of wild-type spores, while *gerAA* and wild-type spores had similar viability. Collectively, these results suggest that the GerAA and GerKC proteins play roles in normal germination of *C. perfringens* NFB isolates and that GerKC, but not GerAA, is important in these spores' apparent viability.

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INTRODUCTION

Clostridium perfringens is a Gram-positive, spore-forming, anaerobic, pathogenic bacterium capable of causing a wide variety of diseases in humans and animals (McClane *et al.*, 2004; McClane, 2007; McDonnell, 1986). The two most common illnesses in humans are *C. perfringens* type A food poisoning (FP) and non-food-borne (NFB) gastrointestinal (GI) illnesses (Carman, 1997; McClane, 2007). These two major diseases are caused mainly by *C. perfringens* type A isolates producing *C. perfringens* enterotoxin; these isolates account for ~5 % of type A isolates (Asha & Wilcox, 2002; Sarker *et al.*, 1999; Wen & McClane, 2004). Interestingly, differences between FP and NFB isolates include not only the localization of *C. perfringens* enterotoxin-encoding gene (*cpe*) on the chromosome or plasmid, respectively (Collie & McClane, 1998; Cornillot *et al.*, 1995), but also significant differences in their spore resistance (Sarker *et al.*, 2000). Numerous studies have highlighted the enhanced ability of spores of FP isolates (FP spores) to survive in the harsh conditions encountered in FP environments compare to

Abbreviations: AK, L-asparagine and KCl; Ca-DPA, Ca^{2+}-dipicolinic acid chelate; DPA, dipicolinic acid; FP, food poisoning; FTG, fluid thioglycollate; GI, gastrointestinal; GR, germinant receptor; NFB, non-food-borne; RT-PCR, reverse transcription PCR.

One supplementary figure and one supplementary table are available with the online Supplementary Material.

applied sciences

MDPI

Article

Thin Film Williamson Nanofluid Flow with Varying Viscosity and Thermal Conductivity on a Time-Dependent Stretching Sheet

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Abstract: This article describes the effect of thermal radiation on the thin film nanofluid flow of a Williamson fluid over an unsteady stretching surface with variable fluid properties. The basic governing equations of continuity, momentum, energy, and concentration are incorporated. The effect of thermal radiation and viscous dissipation terms are included in the energy equation. The energy and concentration fields are also coupled with the effect of Dufour and Soret. The transformations are used to reduce the unsteady equations of velocity, temperature and concentration in the set of nonlinear differential equations and these equations are tackled through the Homotopy Analysis Method (HAM). For the sake of comparison, numerical (ND-Solve Method) solutions are also obtained. Special attention has been given to the variable fluid properties' effects on the flow of a Williamson nanofluid. Finally, the effect of non-dimensional physical parameters like thermal conductivity, Schmidt number, Williamson parameter, Brinkman number, radiation parameter, and Prandtl number has been thoroughly demonstrated and discussed.

Keywords: Williamson fluid; unsteady flow; nanofluid film; HAM and numerical method

1. Introduction

The fluid flow on a nonlinear stretching surface has attracted the attention of several investigators due to its numerous applications in the fields of engineering and industry, such as oil filtering processes, paper making processes, polymer making, food manufacturing and preserving processes, etc. The flow provides more effective results in the manufacturing of good quality products in the engineering field when heat is transferred to it, for instance via metallurgical processes, wire and fiber coating, heat exchange equipment, the polymers extrusion process, the chemical polymer process, good quality glass manufacturing and crystal growing, and so on. In case of a slow cooling rate and stretching rate of electrically conducted fluids, magneto hydrodynamic (MHD) flow provides the best quality products [1]. Sakiadis [2] was the pioneer to study the flow on a linearly stretched surface when the fluid was at rest. Crane [3] examined the flow on the stretching sheet and obtained a similar solution to the problem. He also obtained a closed form exponential solution to the linear flow on the

Review

Key Molecular Drivers of Chronic Lymphocytic Leukemia

Suliman A. Alsagaby,[1,2] Paul Brennan,[2] Chris Pepper[2]

Abstract

Chronic lymphocytic leukemia (CLL) is an adult neoplastic disease of B cells characterized by variable clinical outcomes. Although some patients have an aggressive form of the disease and often encounter treatment failure and short survival, others have more stable disease with long-term survival and little or no need for theraphy. In the past decade, significant advances have been made in our understanding of the molecular drivers that affect the natural pathology of CLL. The present review describes what is known about these key molecules in the context of their role in tumor pathogenicity, prognosis, and therapy.

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Keywords: CLL, Molecular drivers, Pathogenicity, Prognosis, Therapy

Introduction

Chronic lymphocytic leukemia (CLL) is a type of hematologic malignancy affecting B lymphocytes. The malignant cells accumulate in the peripheral blood, bone marrow, lymph nodes, and spleen.[1-3] CLL is an adult neoplastic disease, with most cases reported in people > 65 years old, with a predominance of males to females (2:1).[4,5] Some hereditary factors have been reported to be associated with the risk of developing CLL.[6-8] One of the most obvious manifestations of the genetic predisposition component to CLL is that the disease is more common in whites, and its incidence does not increase in Asian immigrant populations in Western countries.[9] Despite the advances that have been achieved in CLL therapy, the disease remains incurable. However, the latest treatment modalities are able to significantly reduce the disease burden and improve patient survival times.[10-14] The need for therapy varies significantly among patients; some patients might never need treatment, and others require early treatment and often have short survival times.[15-20] In the present review, the key molecular players that greatly affect the pathogenicity, prognosis, and therapy of CLL are discussed.

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B-cell Receptor

B-cell receptor (BCR) complex is made of an assembly of surface immunoglobulin (sIg) and the noncovalently bound heterodimer CD79a/CD79b.[1] Stimulation of the BCR on CLL cells has been implicated in a number of biologic processes that promote CLL disease progression, including cell migration, proliferation, and survival. Stimulation of CLL cells by BCR engagement increases chemotaxis toward CXCL12 and CXCL13 and promotes cellular proliferation.[21-24] Engagement of the BCR can also rescue CLL cells from apoptosis by inhibiting caspase activity, increasing the expression of antiapoptotic proteins such as BCL-2, MCL-1, phosphorylation (deactivation) of the proapoptotic protein BIM, and activation of JAK2/STAT3.[21,25-27] Despite the importance of BCR in the progression of the disease, its expression is reduced in CLL cells compared with normal B cells.[1,28,29] Various mechanisms have been proposed to account for this observation. For instance, reduced expression of the BCR on CLL cells has been associated with point mutations, deletions, and insertions in the gene encoding CD79b.[30] Defective glycosylation and folding of CD79a and μ-chain were also found to combine with low expression of BCRs on CLL cells.[31]

Somatic hypermutation of the immunoglobulin heavy chain (*IGHV*) genes of B cells occurs in the germinal centers and is essential for defining the affinity and antigen specificity of the BCR.[32] About 45% of CLL patients have unmutated *IGHV* genes (UM-CLL), indicating that these B cells have not undergone somatic hypermutation.[15,16] Although CLL cells express less sIg than normal B cells, UM-CLL shows increased expression of sIg compared with *IGHV*-mutated (M-CLL) cases.[29] This finding affects both the pathogenicity and the prognosis of UM-CLL.

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Methanolic extract of *Peganum harmala* exhibit potent activity against *Acanthamoeba castellanii* cysts and its encystment *in vitro*

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Abstract: *Acanthamoeba castellanii* is member of free living amoeba that may cause painful sight-threatening keratitis and life threatening encephalitis which involves central nervous system. Treatments for both infections are problematic because of the amoebic cysts resistance to therapeutic agents. Here we evaluated *in vitro* strength of methanolic seed extract of *Peganum harmala* on *Acanthamoeba* cysts and its encystment mechanism. Our results revealed seed extracts (1 to 30mg/ml) exhibited amoebicidal effects against *Acanthamoeba* cysts. Furthermore *Acanthamoeba* encystment was also inhibited in concentration dependent manner with maximum inhibition at 2µg/ml after 48h incubation. In conclusion, we demonstrated for the first time that methanolic extracts exhibit remarkable inhibition of *Acanthamoeba* cysts and encystment *in vitro* which could serve a potential new natural agent against *Acanthamoeba*.

Keywords: *Acanthamoeba*; amoebicidal effects; encystment; plant extracts.

INTRODUCTION

Genus *Acanthamoeba* is member of free-living amoebae that is an opportunistic protozoan pathogen and ubiquitous in nature. *Acanthamoeba* is known to cause serious human diseases like (i) chronic granulomatous infection involving central nervous system always leading to death, (ii) disseminated infections including skin, sinuses, lungs, prostate and uterus and (iii) painful keratitis (an infection of the eye resulting in blindness) mostly related to contact lens wearers (Trabelsi *et al.* 2012). Clinical symptoms of *Acanthamoeba* granulomatous encephalitis (AGE) includes fever, headaches, neurological disorders, personality changes and coma. *Acanthamoeba* keratitis (AK) is distinguished by ophthalmalgia, photophobia, blue-red vision and blood extravasations. In some cases like the lungs, *Acanthamoeba* may cause various inflammatory foci (AP), which are escorted by the exudation of serous fluid which carry trophozoites and cysts. In case of skin which changes into various ulcerations. All above mentioned infections are usually chronic.

Acanthamoeba lives two stage life cycle i) active trophozoite (infectious stage) and ii) dormant cyst (non-pathogenic or inactive) stage. *Acanthamoeba* infections are always very difficult to treat and mostly ineffective. Although a number of antimicrobials have been used in the past to treat *Acanthamoeba* infections but no drug has been found to be useful. There have been few successful treatments reports which were achieved due to the use of combination of drugs against *Acanthamoeba* trophozoites (Gautom *et al.,* 1998). In spite of this *Acanthamoeba* eradication from the infection site is very difficult because under unfavorable conditions (i.e. drug treatment), the amoebas trophozoite switch over to cyst stage and medical treatment (drugs) is mostly less effective against amoeba cysts than trophozoites due to the stiff double-wall of the cysts which enables it extreamly resistant to anti-amoebic drugs. This is also problematic as cysts have the capability to resist and survive after initial successful chemotherapeutic administration and cause deterioration of the disease. Encystment is the strategic mechanism amoeba adopts to combat the external threat i.e. harsh environmental conditions and/or drug treatment. The capability of cysts to resist chemotherapeutic agents is perhaps a key factor which contributes the increased cases of protozoan infections.

There is an essential need to have a better antimicrobial chemotherapy and alternate strategies to build up therapeutic interventions. The search for new compounds originating from natural resources is an important research area. Many new natural product groups have been identified for antiparasitic properties of with their astonishing efficacy and selectivity such as plant-derived terpenes, alkaloids and phenolics (Kayser *et al.* 2003). We have previously investigated various plant extracts and reported *Peganum harmala* have shown the promising effects against *Acanthamoeba* trophozoites (Shohaib *et al.,* 2013). Therefore use of extracts could have promising outcome in the treatment of *Acanthamoeba* infections. Here, we investigated efficacy of *P. harmala* against *Acanthamoeba* cysts and its encystment mechanism to evaluate a potential therapeutic option of the extract against amoebic encystment using an *in vitro* model.

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Research article

X-RAY SPECTROMETRY

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Assessing silicon deposits in Zilfi province, Saudi Arabia, using XRF and XRD techniques

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The aim of this project is to create a geochemical database of the Nafud Desert in Zilfi Province, which lies 260 km northwest of Riyadh, capital of Saudi Arabia, and assess its potential as a silicon mine. The area of study was surveyed during December 2012 collecting 21 geological samples from 7 places (Alsabla, Almatal, Shlwan, Alaaga, Jaway, Magra and Althuare).

Elemental composition was determined using X-ray fluorescence spectrometry, while mineral content and crystallography analysis was performed using X-ray diffraction.

Analysis results revealed that silicon was abundant in the area, in fairly homogeneous amounts. Silica was found in concentrations of around 93% per sampled mass, and silicon concentrations were around 42%, in the surface layers down to the depth of 40 cm.

Other elements (Al, K, Ca, Ti, Cr, Mn, Fe, Sr, Zr and Pd) were present in very low concentrations, except for aluminium oxide, which was present in three areas (Jaway, Magra and Althuare) at concentrations around 5%, while Alsabla samples showed higher concentrations of CaO. Thus, according to the results, the Nafud Desert is a rich source of silicon that can be exploited very cheaply because of the presence of the raw material on the surface. Copyright © 2016 John Wiley & Sons, Ltd.

Introduction

Silicon (Si) is one of the most abundant elements in the continental crust and consequently is utilized in many industries extending from house hold items to advanced technologies.[1–4] However, silicon metal demand comes predominately from the aluminium and chemical industries, with more than 75% of silicon metal produced worldwide, is normally used by the chemical industry.

In Saudi Arabia, the production and demand for silicon is expected to rise because of to the expansion of the existing companies operating in the minerals sector. Furthermore, Saudi Arabia is best positioned to attract silicon ingot/wafer projects because of many favourable reasons including the relatively inexpensive energy resources, spacious and flexible production plots, and local glass production.[5]

Assessment of mineral deposits are usually conducted via physical and chemical analysis of geological samples using techniques such as inductively coupled plasma-mass spectrometry (ICP-MS),[6–8] emission and atomic absorption spectrometry[9] and neutron activation analysis (NAA).[10] X-ray fluorescence (XRF) and X-ray diffraction (XRD) are two of the most utilized techniques for the determination of elemental and chemical composition of such samples.[11,12] XRF has the advantage of minimum sample preparation and high-detection sensitivity for a wide range of elements extending from sodium to uranium, with great accuracy,[13] while XRD offers the possibility of identifying the crystal structure of the chemical compounds present in the sample.[14]

The aim of this project is to advance current research attempting to create a geochemical database of the studied area, which would be useful for assessing the potential of the area as a silicon mine, and to aid future explorations.

Material and methods

Nafud Desert in Zilfi province, which lies 260 km northwest of Riyadh, the capital of Saudi Arabia. The area of study was surveyed during December 2012 collecting 21 geological samples (100 g each) from seven places (Alsabla, Almatal, Shlwan, Alaaga, Jaway, Magra and Althuare), by collecting three samples from each place: at the surface, 20 cm and 40 cm depths. To ensure good representation, samples were first sieved using a 200 mm sieve and then mixed thoroughly before being milled using a mortar and pestle.

All the samples were analyzed using an X-ray Analytical Microscope (XGT 7200, Horiba, Japan)[15] operating with a rhodium (Rh) X-ray tube and an energy dispersive, peltier cooled silicon drift detector, capable of detecting elements from sodium (Na) to uranium (U). Operational conditions were: 50 kV tube's high voltage, 0.5 mA tube current, and 1000 s per point analysis time. A mono glass capillary is utilized to generate a 1.2 mm X-ray spot on the surface of the sample. Analysis was conducted under vacuum to improve the detection sensitivity of light elements. Elemental composition was determined for oxides as mass percentages.

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Flow and heat transfer of two immiscible fluids in double-layer optical fiber coating

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Abstract The coatings of optical fibers are generally characterized by a multi-layer coating structure. In this work, the mathematical modeling of two immiscible non-Newtonian fluids for optical fiber coating inside a straight annular die is developed in the form of a nonlinear differential equation with nonhomogeneous boundary conditions. Two non-Newtonian fluids, namely power law and Phan-Thien–Tanner fluids, are used in the primary and secondary coating dies, respectively. An exact solution is obtained for velocity fields and temperature distributions for the primary and secondary coating resins. The thickness of coated fiber optics is also calculated for both layers. The effect of different emerging parameters on the solution is discussed and sketched.

Keywords Power law fluid, PTT fluid, Fiber coating, Two-layer coating, Coating die

Introduction

The subject of two-fluid flow and heat transfer has been extensively studied due to its importance in chemical and nuclear industries.[1] The immiscibility of two fluids is a result of strong cohesion forces between their molecules, and depends on the nature of the fluids. The ease with which the fluids can be mixed is expressed with an experimentally determined coefficient known as surface tension. The larger the value of this coefficient is, the stronger the resistance is to be mixed. A negative value indicates no resistance to mixing.[1] The flow of immiscible fluids can be classified into three groups based on the interfacial structures and topographical distributions of the phases, namely segregated flows, transitional or mixed flows, and dispersed flows.[2] The three classes can be explained by considering a closed container filled with a liquid and a gas. Segregated flows occur when the container is oscillating very gently with a low amplitude and frequency and the liquid and the gas remain separated with a single well-defined interface. Mixed or transitional flows occur when the frequency and amplitude have increased to the extent that the waves become unstable and break, which results in the breaking down of the parts of the interface and trapping of the small bubbles in the liquid. Dispersed flows occur when the container is shaken violently and the gas is suspended as small bubbles within the liquid. Meyer and Garder[3] were the first authors to publish a paper on the mechanics of two immiscible fluids in porous media. Lohrasbi and Sahai[4] analyzed the flow of two immiscible fluids in a parallel plate channel by the assumption that the velocity and thermal equilibrium at the interface were continuous. Several other researchers have assumed that the separated two-phase flow can be well represented by the superimposition of two single-phase flows separated by a fiat interface.[5,6] In general, multi-phase flows can be driven by gravitational and viscous flows. The laminar flow of two immiscible fluids in a horizontal pipe has been widely studied theoretically and experimentally.[7,8] Lohrasbi and Sahai[4] studied the two-phase magnetohydrodynamic flow and heat transfer in a parallel plate channel with one of the fluids being electrically conducting. Later on,

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Nanoscale Research Letters

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MHD Natural Convection Flow of Casson Nanofluid over Nonlinearly Stretching Sheet Through Porous Medium with Chemical Reaction and Thermal Radiation

Imran Ullah[1], Ilyas Khan[2] and Sharidan Shafie[1*]

Abstract

In the present work, the effects of chemical reaction on hydromagnetic natural convection flow of Casson nanofluid induced due to nonlinearly stretching sheet immersed in a porous medium under the influence of thermal radiation and convective boundary condition are performed numerically. Moreover, the effects of velocity slip at stretching sheet wall are also examined in this study. The highly nonlinear-coupled governing equations are converted to nonlinear ordinary differential equations via similarity transformations. The transformed governing equations are then solved numerically using the Keller box method and graphical results for velocity, temperature, and nanoparticle concentration as well as wall shear stress, heat, and mass transfer rate are achieved through MATLAB software. Numerical results for the wall shear stress and heat transfer rate are presented in tabular form and compared with previously published work. Comparison reveals that the results are in good agreement. Findings of this work demonstrate that Casson fluids are better to control the temperature and nanoparticle concentration as compared to Newtonian fluid when the sheet is stretched in a nonlinear way. Also, the presence of suspended nanoparticles effectively promotes the heat transfer mechanism in the base fluid.

Keywords: Casson fluid, Chemical reaction, Slip condition, Thermal radiation, Convective boundary condition

Background

Nanofluid is a new class of fluid consists of nanometer-sized particles suspended in a base fluid. Poor heat transfer fluids such as water, ethylene glycol, and engine oil have low thermal conductivity, and are considered essential for heat transfer coefficient between the heat transfer medium and the heat transfer surface. It has been proven through experiments that the thermal conductivity of nanofluid is appreciably higher than the base fluids. The term "nanofluid" was first coined by Choi and Eastman [1] and discovered that suspended nanoparticles in the base fluid can enhance the thermal conductivity of base fluid efficiently. The nanoparticles are typically made of Al_2O_3, SiC, AlN, Cu, TiO and graphite, and have high thermal conductivity as compared to conventional base fluids. Eastman et al. [2] further explored that the addition of copper (10 nm) particles in ethylene glycol increases the thermal conductivity up to 40%. Later on, many researchers [3–5] reported that addition of 1–5% by volume of nanoparticles to ordinary heat transfer fluids can enhance the thermal conductivity more than 20%. Boungiorno [6] pointed two slip mechanisms, i.e., Brownian motion and thermophoresis out of seven slip mechanisms that effectively enhance the thermal conductivity of base fluid. Brownian motion is responsible for the collision of nanoparticles moving in the base fluid. In fact, heat transfer due to the collision of two particles could enhance the thermal conductivity of nanofluids. The comprehensive references and in-depth understanding on nanofluid can be insight in most recent articles [7–9].

The boundary layer flow caused by stretching a sheet linearly or nonlinearly is an important engineering problem and has several industrial applications, including

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Phase space localized functions in the Dunkl setting

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Abstract Time–frequency analysis plays a central role in signal analysis, because signals that have highly concentrated time–frequency content are used in many applications. The uncertainty principle in Fourier analysis sets a limit to the possible simultaneous concentration of a function and its Dunkl transform. To localize signals in the time–frequency plane we use time–frequency localization operators in the Dunkl setting to measure their time–frequency content on some subset of finite measure. Then, using eigenfunctions of these operators, which are maximally time–frequency concentrated, we prove a characterization of functions that are time–frequency concentrated in the region of interest, and we obtain approximation inequalities for such functions using a finite linear combination of eigenfunctions.

Keywords Time–frequency concentration · Localized functions · Dunkl-Gabor transform · Localization operator · Spectrogram

Mathematics Subject Classification 94A12 · 45P05 · 42C25 · 42C40

1 Introduction

During the last years, there has in particular been a rapid development in the area of special functions with reflection symmetries and the harmonic analysis related with

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Regular paper

Journal of Electrical Systems

Development of compact thermal model with two exchange surfaces

The design of electronic power converters includes many aspects such magnetism, material choice, geometry and heat transfer. Their simulations require complex and iterative methods. The compact thermal model (CTM) can then be used to limit the computation time in the design stage. In the model adopted in this paper, the system is represented by two exchange surfaces. An impedance matrix is used to link the temperature of the surfaces to the heat fluxes. This matrix should be independent of the boundary conditions applied at each exchange surface. The computation of the impedance matrix elements versus the frequency is explained. The model is validated using finite element simulations.

Keywords: Thermal approach; thermal impedance matrix; boundary condition independence; simulation.

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1. Introduction

Passive components used in power electronics (i.e. capacitors, inductors and transformers) are characterized by impedances measured at the operating frequency [1]-[2]-[3]. Putting more components in a smaller package has complicated the thermal process [4]. So, the thermal design has become of high priority in order to maintain system performance, reliability and low-cost products [5]. The compact thermal model (CTM) is a simple way to save time consuming at the simulation stage [6]-[7]. To develop these models for simple geometry, analytical approaches [8]-[9] can be done. For complicated device, numerical approach as the finite element methods must be performed [10]-[11]. To minimize the computation time, reduced models can be used. The nodal method has proved to be an effective method in many applications [12]-[13]. It is a flexible method to use particularity in the case of model reduction. This method is based on a thermal – electrical analogy. It can be adapted to different areas of physics and sensitivity studies. Kevin J. Kerns et al [14]-[15] introduces the PACT method which is a mathematical process that can be used to reduce a RC network by preserving its poles. J. Pailhes et al [16] presents a quadrupole technique for heat transfer modeling in multilayer spreader with heat sources. The idea is to use hyperbolic functions and numerical problems according to the argument value that depends on geometrical and thermophysical properties as well as characteristics times. The use of this formulation in the equivalent impedance networks allow to run efficiently the thermal behaviour of multilayered spreader. The reduced model proposed in this paper is dedicated to the modeling of magnetic components by using a matrix

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Islands of stability and quasi-magic numbers for super- and ultra-heavy nuclei

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Abstract: In the framework of Strutinsky's approach, we calculated the shell and the residual pairing correction energies for 5569 even-even nuclei in the range $72 \leqslant Z \leqslant 282$ and $96 \leqslant N \leqslant 540$. Quasi-magic numbers and deformed islands of stability that reside in a range defined by Green's formula and the two-neutrons drip line are introduced. We present 36 quasi-magic proton and 53 quasi-magic neutron magic numbers that contribute to the formation of 133 deformed islands of stability along the N-Z space. The quasi-magic proton and neutron magic numbers volatile as the mass number increases and other magic numbers take over. Consequently, the deformed islands of stability fail to exhibit a pattern along the search space covered.

Keywords: deformed nuclei, islands of stability, magic numbers

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1 Introduction

Experimental results on the structure of neutron-rich isotopes have tested the assumption that magic numbers are probable for spherical as well as deformed shapes. For systems with an unbalanced proton-to-neutron ratio, the original magic numbers may disappear while others emerge. In Ref. [1], Doornenbal et al. suggested that a large area of deformation emergences in the range $N = 20 - 28$ shell quenching. Furthermore, it was experimentally found that heavy nuclei of the actinium series ($Z = 93{-}103$) are well deformed [2, 3]. This fact strongly suggests that deformed configurations are as important as spherical ones for stability of the heaviest nuclei. In Ref. [4], Bohr and Mottelson also pointed out that deformation can play a major role in increasing stability in the heavy regions. Muntian, Patyk, and Sobiczewski argued that superheavy nuclei around $^{270}_{162}\mathrm{Hs}_{108}$ are deformed [5]. It turned out that extracting information on deformation is crucial for understanding the structure of superheavy nuclei, especially with the advent of new tools and techniques for experimental nuclear physics. The newly developed and the upcoming experimental facilities produce even more new isotopes. Thus, the structure of superheavy nuclei is a topic of current interest which has been intensively studied in the last few years and is worthwhile to explore using various theoretical approaches.

When nuclear deformations are taken into consideration, it results in the appearance of additional minima in the shell correction energy surfaces[6–8, 10–13, 34]. Arguably, these additional minima correspond to filling of the shells in deformed nuclei and represent quasi-magic numbers. In many cases, deformation essentially provides an additional binding which attracts the system to even stronger shell stabilization [9]. Recently, many theoretical calculations were used in an attempt to find out deformed shell closures in a wide range of the nuclear landscape.

In Refs. [14–15], Patyk et al. and Möller et al. calculated an island of deformed shell closures around Z=108, respectively. In recent experiments at GSI [16, 17] and Dubna [18, 19], this region has been accessed, where among many other isotopes the region around the expected deformed doubly magic nucleus $^{270}_{162}\mathrm{Hs}_{108}$ has been reached. Furthermore, based upon the finite-range droplet model, P. Möller and J. Nix also predicted large shell gaps in the region where Z=104, 106, 108, 110 and at N=162, 164 [15].

In the framework of relativistic Hartree-Bogoliubov theory, calculations with a finite-range pairing force of Gogny effective interaction D1 and effective interaction NLSH [20] show that $Z = 114$ and $N = 160$, 166, 184 exhibit stability compared to their neighbors and a doubly magic character at $Z = 106$ and $N = 160$ is also indicated in Ref. [20]. The Skyrme-Hartree-Fock method with ef-

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RESEARCH Open Access

Exact solutions for unsteady free convection flow over an oscillating plate due to non-coaxial rotation

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Abstract

Background: Non-coaxial rotation has wide applications in engineering devices, e.g. in food processing such as mixer machines and stirrers with a two-axis kneader, in cooling turbine blades, jet engines, pumps and vacuum cleaners, in designing thermal syphon tubes, and in geophysical flows. Therefore, this study aims to investigate unsteady free convection flow of viscous fluid due to non-coaxial rotation and fluid at infinity over an oscillating vertical plate with constant wall temperature.

Methods: The governing equations are modelled by a sudden coincidence of the axes of a disk and the fluid at infinity rotating with uniform angular velocity, together with initial and boundary conditions. Some suitable non-dimensional variables are introduced. The Laplace transform method is used to obtain the exact solutions of the corresponding non-dimensional momentum and energy equations with conditions. Solutions of the velocity for cosine and sine oscillations as well as for temperature fields are obtained and displayed graphically for different values of time (t), the Grashof number (Gr), the Prandtl number (Pr), and the phase angle (ωt). Skin friction and the Nusselt number are also evaluated.

Results: The exact solutions are obtained and in limiting cases, the present solutions are found to be identical to the published results. Further, the obtained exact solutions also validated by comparing with results obtained by using Gaver–Stehfest algorithm.

Conclusion: The interested physical property such as velocity, temperature, skin friction and Nusselt number are affected by the embedded parameters time (t), the Grashof number (Gr), the Prandtl number (Pr), and the phase angle (ωt).

Keywords: Non-coaxial rotation, Free convection, Oscillating, Laplace transform technique

Background

Newtonian fluids obey Newtons law of viscosity and are usually described by Navier Stokes equations. Examples of Newtonian fluids are water, air, ethanol, alcohol, benzene, and mineral oils. In general, all gases and most liquids with a simpler molecular formula and low molecular weight, such as water, benzene, ethyl alcohol, hexane and most solutions of simple molecules, are Newtonian fluids. The problems of Newtonian fluids are complicated due to the non-linearity of Navier Stokes equations. This difficulty

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Performance evaluation of corrugated steel fiber in cementitious matrix

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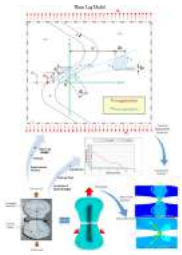
HIGHLIGHTS

- Enhancing in interfacial bond strength due to the corrugation.
- Shear lag model and relations of traction separation for fiber in corrugated shape.
- Greater bond strength might be obtained by setting larger inclination in corrugation.
- Recognized evolution in bond strength allows the fiber to reach its yield strength before the failure in bond strength.

GRAPHICAL ABSTRACT



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Bond strength
Fiber reinforced concrete
Pull-out

ABSTRACT

Increasing the adhesion efficiency between the fiber and the concrete, in fiber reinforced concrete members, might be obtained by enhancing the properties of the concrete mixture using several parameters such as cement weight, water to cement ratio, grading curve of aggregates and admixtures, or by apply some changes on the fiber parameters such as the aspect ratio (l/d) or the outer roughness or the embedded length and the diameter value. Laboratory experiments lead to the fact that the use of smooth and straight steel fiber, in fiber reinforced concrete, produces weak bond strength between the fiber and the concrete. Therefore, to obtain better bond strength it is necessary to increase the total length of the fiber, which may cause unacceptable workability. Accordingly, it could be developed a new form of fiber has larger supporting region using the corrugated fiber shape. In this paper, the performance of this corrugated form will be monitored through new shear lag model to extract the traction separation relations between the corrugated fiber and the concrete matrix, as well as an experimental study using different values of embedded length of the fiber, in addition to several computer simulations which will be created using a finite element model and applying same dimensions and forces which are used in the laboratory experimental procedure. Through the results of nonlinear analysis of the computer simulations, the distribution of stresses in different directions for each of the concrete and the fiber can be shown, then the evolution of the bond strength between the fiber and the concrete can be monitored as an actual result of applying the corrugated shape.

1. Introduction

Since the idea of using fiber reinforced concrete is desirable widespread worldwide, and design guidelines of steel fiber reinforced concrete are still unavailable, the relevant scientific researches are still going forward to understand precisely the mechanical behavior of this structural composite material. Usually pull-out test is used to monitor the development of the mechanical behavior of the fiber in concrete matrix.

In Steel Fiber Reinforced Concrete (SFRC) many types of steel fiber are generally used, and these different types might be

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Numerical Study of the Electrothermal Effect on the Kinetic Reaction of Immunoassays for a Microfluidic Biosensor

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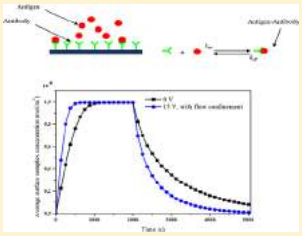
ABSTRACT: In this work, we simulate the binding reaction of C-reactive protein in a microchannel of a biosensor. A problem that arises in this device concerns the transport of the analyte toward the reaction surface of the biosensor, which is of a very small dimension. The limitation of mass transport causes the formation of a diffusion boundary layer and restrains the whole kinetic reaction. To enhance the performance of the biosensor by improving the transport, an applied AC electric field and flow confinement are used to stir the flow field. The numerical simulation of these mechanisms on the binding reaction is performed using the finite element method. Swirling patterns are generated in the fluid. They enhance the transport of the analyte and confine it near the reaction surface. The location of the electrode pair on the walls of the microchannel for the design of the biosensor has been studied to find out the effects of varying geometric configurations on the binding efficiency. The best performances of the biosensor are obtained when the electrodes are placed on the same wall of the microchannel as the reaction surface. For the best case, under the effect of the applied electric field alone, the enhancement factors raise up to 2.46 and 2.10 for the association and dissociation phases, respectively. By contrast, under the effect of the electric field with flow confinement, the enhancement factors for the association and the dissociation phases jump to 3.43 and 2.97, respectively, for 30:1 flow confinement (ratio of confining to sample flow).



INTRODUCTION

In the last decade, the emerging field of microfluidics seeks to take advantage of biology in union with the growth of micro/nanotechnologies in a wider context, encompassing, for example, microfluidic biosensors for health-care applications (e.g., immunoassays), DNA sequencing, nanoparticles detection, protein separation, and other biomedical clinical diagnostic techniques.[1] The advantages of microfluidic devices are tremendous including high throughput, short analysis time, the ability to operate with small samples, and high sensitivity.[2] These devices employ low sample volumes, make available fast reaction rates because of the smaller diffusion distances, are easy to fabricate, and can include integrated sensors to provide label-free analysis.[3,4] Devices, with channels of the size of tens of microns, are being developed for use in a variety of applications such as enzymatic analysis,[5,6] DNA analysis,[7] proteomics analysis,[8] and nanoparticle fabrication.[9] Rapid advances in nanotechnologies have given thrust to the development and conception of microfluidic biosensors for health-care applications such as immunoassays. Recently, miniaturization of the microfluidic systems to integrate advanced biosensors into lab-on-a-chip systems have attracted a lot of attention.[10,11] The biosensor consists of three components, namely, quantum dot−enzyme conjugates, hydrogel microstructures, and a set of microchannels. These components are integrated into a microfluidic device. Lee et al. have developed a chip-based microfluidic device that has a multichannel configuration to detect microarray immunoassay samples based on a surface plasmon resonance (SPR) detection system.[12]

The lab-on-a-chip systems have proven to be a promising approach for the diagnosis of several human diseases, allowing accurate detection of low-concentration disease marker proteins or biomolecules. For example, C-reactive protein (CRP) is a biomarker of inflammation, which increases rapidly in response to tissue infection or inflammation, especially in cases of cardiovascular disease.[13] In addition, serum CRP concentrations can be used to assess the risk of cardiovascular diseases.[14] Fractal analysis is used for the binding and dissociation of prion proteins to biosensor surfaces. It provides a quantitative measure of the degree of heterogeneity on the biosensor surface.[15] The SPR sensor,[16] the quartz crystal microbalance (QCM) sensor,[17] and the immunoassays are the principal methods used in most cases for the detection of

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Research Article

Mesenchymal Stem Cells Loaded with p5, Derived from CDK5 Activator p35, Inhibit Calcium-Induced CDK5 Activation in Endothelial Cells

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The potential use of stem cells as therapeutics in disease has gained momentum over the last few years and recently phase-I clinical trials have shown favourable results in treatment of a small cohort of acute stroke patients. Similarly, they have been used in preclinical models drug-loaded for the effective treatment of solid tumours. Here we have characterized uptake and release of a novel p5-cyclin-dependent kinase 5 (CDK5) inhibitory peptide by mesenchymal stem cells and showed release levels capable of blocking aberrant cyclin-dependent kinase 5 (CDK5) signaling pathways, through phosphorylation of cyclin-dependent kinase 5 (CDK5) and p53. These pathways represent the major acute mechanism stimulating apoptosis after stroke and hence its modulation could benefit patient recovery. This work indicates a potential use for drug-loaded stem cells as delivery vehicles for stroke therapeutics and in addition as anticancer receptacles particularly, if a targeting and/or holding mechanism can be defined.

1. Introduction

Despite all recent advances in ischemic stroke research, treatments and recovery rates of patients have not been improved significantly [1]. Such a clinical scenario underscores the importance of investing in new therapeutic approaches. The preclinical and clinical studies have shown that stem cell-based therapies have the enormous potential for the treatment of a wide range of diseases [2]. Adult stem cells have been studied extensively and are already a successful source of FDA-approved treatments for a number of diseases including juvenile diabetes and Parkinson's disease. In contrast to the treatment of diseases such as diabetes and Parkinson's disease where restricted populations are lost, multiple cell types are lost in stroke and it will be important to repair both blood vessels (endothelial cells, smooth muscle cells, and pericytes) and neurons and glial cells [3–5]. Another important distinction is that stroke is an acute injury limited in time, which might make the brain more hospitable to transplantation than in other diseases. Mesenchymal stem cells (MSCs, also called mesenchymal stromal cells) have the advantage of being relatively easy to propagate *in vitro* and implantation of autologous MSCs into patients has fewer ethical problems and is not subject to alloimmunization and thus may represent an ideal candidate for cellular therapies [6].

Cyclin-dependent kinase 5 (CDK5), a serine/threonine kinase, in complex with its activators, p35 (protein of 35 kDa) and p39 (protein of 39 kDa), is essential for early neurodevelopment in mammals [1]. However, a variety of neurotoxic conditions, such as ischemic brain damage, oxidative stress, amyloid β peptide (Aβ), excitotoxicity, calcium dyshomeostasis, and inflammation, induce influx of calcium

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Original Research

Neuroprotective effects of herbal cocktail on cerebrovascular dysfunction in rats with induced hyperhomocysteinaemia

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Abstract

Introduction: Hyperhomocysteinaemia (HHcy) is an established risk factor for cardiovascular, cerebrovascular, peripheral vascular diseases and neurodegenerative disease. The effect of this HHcy on vascular diseases could potentially cause vascular pathology features. Experimental studies have demonstrated that Hcy can be neurotoxic to brain, hippocampus area. **Methods:** The present study was conducted to compare the possible neuroprotective effects of different herbal cocktail in HHcy-induced rats' brain cerebrovascular dysfunction model. Rats were divided into nine groups: Group I - Controls received the same volume of saline solution (0.5 mL/100 g of body weight). Group II served as HHcy and received homocysteine 0.03 µmol/g of b.w. daily for 30 days. Group III served as HHcy and received homocysteine 0.03 µmol/g of b.w. + Artemisia Judaica extract (AJ) (50 mg/kg per oral by oral feeding needle with tuberculin syringe) daily for 30 days. Group IV served as HHcy and received homocysteine 0.03 µmol/g of b.w.+ Panax ginseng extract (PG) (50 mg/kg per oral by oral feeding needle with tuberculin syringe) daily for 30 days. Group V served as HHcy and received homocysteine 0.03 µmol/g of b.w. + Polygonum multiflorum extract (PM) (400 mg/kg per oral by oral feeding needle with tuberculin syringe) daily for 30 days. Group VI served as HHcy and received homocysteine 0.03 µmol/g of b.w. + AJ + PG with the same dose of previous group daily for 30 days. Group VII served as HHcy and received homocysteine 0.03 µmol/g of b.w. + AJ + PM with the same dose of the previous group daily for 30 days. Group VIII served as HHcy and received homocysteine 0.03 µmol/g of b.w. + PG + PM with the same dose of the previous group daily for 30 days.

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SINGULAR LIMITS FOR 4-DIMENSIONAL GENERAL STATIONARY Q-KURAMOTO-SIVASHINSKY EQUATION (Q-KSE) WITH EXPONENTIAL NONLINEARITY

TAIEB OUNI, SAMI BARAKET AND MOUFIDA KHTAIFI

Abstract

Let Ω be a bounded domain in $\mathbb{R}^4$ with smooth boundary, and let $x^1, x^2, \cdots, x^m$ be points in Ω. We are concerned with the singular stationary non-homogenous q-Kuramoto-Sivashinsky eaquation (q-KSE):

$$\Delta^2 u - \gamma \Delta u - \lambda |\nabla u|^q = \rho^4 e^u$$

where we use some nonlinear domain decomposition method to give a sufficient condition to have a positive weak solution u in Ω under the physical Dirichlet-like boundary conditions $u = \Delta u = 0$ on $\partial\Omega$, which is singular at each x^i as the parameters λ, γ and ρ tend to 0 and where $q \in [1, 4]$ is a real number.

Key Words: Singular limits, Green's function, Kuramoto-Sivashinsky equation, Exponential nonlinearity, Nonlinear domain decomposition method.
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Principal Component Analysis for pulse-shape discrimination of scintillation radiation detectors

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ABSTRACT

In this paper, we report on the application of Principal Component analysis (PCA) for pulse-shape discrimination (PSD) of scintillation radiation detectors. The details of the method are described and the performance of the method is experimentally examined by discriminating between neutrons and gamma-rays with a liquid scintillation detector in a mixed radiation field. The performance of the method is also compared against that of the conventional charge-comparison method, demonstrating the superior performance of the method particularly at low light output range. PCA analysis has the important advantage of automatic extraction of the pulse-shape characteristics which makes the PSD method directly applicable to various scintillation detectors without the need for the adjustment of a PSD parameter.

1. Introduction

In several scintillation detectors sensing differences in the shape of output pulses provide very useful information on the type of radiation interacting with the detector. This is commonly referred to as pulse-shape discrimination (PSD). The most common PSD application is in the discrimination between neutrons and gamma-rays with organic scintillation detectors used as fast neutron detector [1]. The PSD techniques are also widely used in applications involving phoswich scintillation detectors [2]. The traditional PSD methods are the Charge-Comparison (*CC*) and the Zero-crossing (*ZC*) methods which have been implemented on analog circuitry for several decades [3,4]. The *CC* method is based on the comparison of integrals of the pulses for two different time intervals while in the *ZC* method a zero-crossing time bears the pulse-shape information. In recent years, there has been tremendous interest in using digital pulse-processing methods for PSD of scintillation detectors and a number of techniques such as digital versions of *CC* and *ZC* methods have been used for this purpose [5,6]. Moreover, pure digital techniques based on curve fitting [7], frequency domain analysis [8] and neural networks [9] have been used for PSD applications. Furthermore, digital PSD systems with the capability of real-time operation have been developed [10]. However, the available PSD methods are either computationally time intensive or require a PSD parameter to be precisely adjusted in accordance to the pulse-shape characteristics of the detector concerned. In this paper, a new digital PSD method based on the Principal Component Analysis (PCA) of sampled detector pulses is proposed. PCA is a widely used technique for extracting strong patterns in a dataset and has found applications in various disciplines such as image processing, neuroscience, etc. [11]. Our motivation for employing PCA for PSD applications is that PCA analysis is inherently adaptive to the intrinsic statistical characteristics of the data, and therefore, a PCA-based PSD system would be directly applicable to various scintillation detectors without the need for adjusting a PSD parameter. We describe the details of the method and the performance of the method is experimentally examined by discriminating between neutrons and gamma-rays with a liquid scintillation detector in a mixed radiation field. The performance of the PCA pulse classification algorithm is also compared against that of the conventional *CC* method.

2. The PCA method

In most of the scintillation detectors, a PSD technique makes use of a simple basic fact that the decay-times of a scintillation light pulse are dependent on the type of radiation interacting with the detector. The shape of the pulses is, however, subject to variations due to statistical fluctuations in the number of photoelectrons, time spread in the photomultiplier tube (PMT) and electronic noise [12]. Our PSD method is based on the employment of a PCA analysis for extracting the patterns in the decay-times of sampled PMT pulses, thereby different types of radiation can be identified. A comprehensive review of PCA can be found in many

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Electrokinetic effects on pressure driven flow of viscoelastic fluids in nanofluidic channels with Navier slip condition

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ABSTRACT

The flow of viscoelastic fluids through micro/nanofluidic systems is an important issue in the biological applications. The electrokinetic effects on pressure driven flow of a viscoelastic fluid through a nanochannel with slip boundary condition are investigated in this study. The rheological behavior of the viscoelastic fluids is described using constitutive equations and the linear Navier's law is employed to consider the slip condition on the channel walls. The Debye–Hückel linearization is employed to obtain a closed form analytical solution for the velocity distribution and induced electric field as function of slip parameter, Reynolds number, viscoelastic parameter, dimensionless Debye–Hückel parameter and dimensionless zeta potential. It is found that the induced electric field increases with increasing both dimensionless zeta potential and dimensionless slip coefficient while it decreases with increasing dimensionless Debye–Hückel parameter.

1. Introduction

Due to smaller Reynolds numbers in microfluidic systems, the flow is assumed to be laminar or simply Stokes flow. This assumption is also valid in nanochannels with/without slip velocity at the walls. In the case of liquid transport through nanochannels, the Knudsen number can be used to check the continuum assumption which is defined as the ratio of the interaction length of molecules and the system characteristic length [1–4], i.e. $Kn = 1/L$. During transportation of liquids through nanochannels, the walls of the channel become charged due to the adsorption or dissociation of ions in the region close to the walls. As a result, a liquid layer is developed with a net charge in this region, that is, electric double layer (EDL) [5,6]. The first layer has an opposite charge on the charged wall and is strongly attracted towards the wall. Whereas, the second layer is poorly attracted towards the wall and can move along the channel and is actually a mobile part on the EDL. So the ions in the mobile part of the EDL undergo a net migration in the opposite direction and carry solvent along with them, thereby causing the movement of the solvent. When the charged surface and the diffuse part of EDL move relative to each other, an electric field is created. This electric field or a pressure gradient along the channel causes the flow through the channel. These two types of flow are called as electroosmotic flow and pressure driven flow, respectively. For the pressure-driven flow, the ions in the channel flow in the direction of pressure gradient, and result in an electric current called streaming current and a potential difference along the channel called streaming potential. The streaming potential drives the ions in the channel to move in the direction opposite to the pressure-driven flow and result in a current called conduction current. So the presence of EDL leads to an electrical force opposed to the pressure driven flow.

For bio-fluids, the suitable constitutive model may be used. For fluids with viscoelastic behavior, an appropriate constitutive equations need to be considered. For instance, the PTT and FENE-P models, are typically used for modeling fluids such as blood [7,8], saliva, synovial fluid [9] or other biofluids containing long chain molecules. During the past two decades, micro/nanofluidic systems have attracted a large amount of attention due to their vital applications in engineering, biology and medicine. The microfluidic and nanofluidic imply fluid motion through or past structures with a size smaller than 100 μm and 100 nm, respectively. The first motivation in studying micro/nanofluidic systems is to move polymers used in DNA separation through solid devices. The fluid flow inside micro/nanofluidic channels was found different from the flow in typical macrosclae channels. The interesting phenomena are to be expected as fluidic dimensions go down the characteristic dimensions. These phenomena, which are prominent in micro/nanofluidic channels, arise from the interactions between working fluid and the walls that include surface tension effects, boundary slip, and electric charge interactions. Since the number of molecules becomes fewer in nanofluidic devices, transport in such devices differs from the microfluidic ones. Electrokinetic transport differs from microfluidic systems due to the influence of the electrical double layer. Wei et al. [10] investigated the purely electroosmotic flow in a

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Three-dimensional flow of an elastico-viscous nanofluid with chemical reaction and magnetic field effects

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ABSTRACT

Magnetohydrodynamic (MHD) three-dimensional flow of an elastico-viscous nanofluid under the influence of mass transfer and chemical reaction is studied. The flow is produced by a bidirectional stretching sheet. Effects of thermophoresis and Brownian motion are also present. In the presence of constant applied magnetic field, the fluid is electrically conducting. Using appropriate transformations, the governing nonlinear partial differential equations are converted into highly nonlinear coupled ordinary differential equations. Homotopy Analysis method (HAM) is employed to find the series solution of the acquired system of equations. h-curves have been drawn to discuss the convergence of HAM solution. Effects of velocity, temperature and concentration profiles on the emerging important parameters is portrayed and discussed graphically. Numerical values of local Nusselt number, skin friction and Sherwood number with different parameters are calculated and examined. It is observed that temperature profile increases and concentration profile decreases with increasing values of Brownian motion parameter *Nb*. It is also noticed that both velocity components decrease with an increase in viscoelastic parameter *k*.

1. Introduction

During the past few decades, study of non-Newtonian fluids has amazingly increased due to their wide range useful industrial and technological applications. Soaps, shampoos, apple sauce, muds, emulsion, sugar solution, chyme, blood at low sheer rate etc. are real life examples that are included in the family of non-Newtonian fluids. Today's literature does not provide any concrete single relation/equation that completely describes the sole properties of all non-Newtonian fluids. Because of this, numerous mathematical models have been proposed by researchers in the literature. Amongst these, elastico-visco fluids are considered to be more industrial applications oriented which include manufacturing of plastic films, glass blowing, extrusion of polymer sheets, hot rolling, crystal growing etc. Much attention has been given in the past to two dimensional stretching flows [1–3]. Nevertheless, fewer attempts can be seen in the case of three dimensional flows. Some interesting and most recent explorations include the study by Hayat et al.[4] discussing the three dimensional MHD three dimensional elastico-viscous fluid over a stretching surface. They used Homotopy Analysis method to solve the said problem. Nadeem et al. [5] discussed magneto hydrodynamic three dimensional Casson fluid past a bidirectional linear porous stretching sheet. Ramzan et al. [6] studied Newtonian heating effects on MHD three dimensional couple stress fluid. They also considered the effects of Joule heating and viscous dissipation. The effects of thermal radiation and variable thermal conductivity on MHD three dimensional on three dimensional viscoelastic fluid flow was discussed by Shehzad et al. [7]. Ramzan et al. [8] explored three dimensional Oldroyd-B fluid under the influence of Newtonian heating. Shehzad et al. [9] examined Magneto hydrodynamic three dimensional flow of Jeffrey fluid with Newtonian heating.

The importance of magnetohydrodynamics (MHD) flow characteristics in industrial and engineering fields cannot be denied due to its wide range applications. These include cooling of nuclear reactors, thermal insulators, accelerators, geothermal systems, nuclear waste disposal, polymer and petroleum technologies, design of cooling systems with liquid metals, pumps, MHD generators and blood flow measurements. Considering all these applications, many researchers investigated the MHD characteristics in stretching surfaces flows. A variety of efforts have been made in the recent past that dealt with the flows in the presence of applied magnetic field. Sohail et al. [10] discussed the numerical solution of two dimensional boundary-layer flow and the heat transfer of a Maxwell fluid past a stretching sheet under the influence of MHD. Flow of MHD stagnation point by a permeable stretching cylinder with combined effects of Soret and Dufour is studied by Ramzan et al. [11]. Hayat et al. [12] examined MHD three-dimensional flow of couple stress nanofluid in the presence of nonlinear thermal radiation. Hayat et al.

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Modeling of Laminar Buoyancy Convection in a Square Cavity Containing an Obstacle

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Abstract The problem of free convection flow and heat transfer of a fluid inside a square cavity having adiabatic obstacle positioned in the center of the cavity has been investigated numerically using a penalty finite element method. Calculations have been made for Rayleigh numbers ranging from 10^2 to 10^7 for an obstacle of aspect ratios AR $= 0, 0.4, 0.5, 0.6$. Nusselt number results are presented for Prandtl number of 0.71 (assuming the cavity is filled with air). Streamline and isotherm contours are also presented. The obtained results demonstrate the effects of pertinent parameters on the fluid flow, thermal fields and heat transfer inside the cavity. The results show that the heat transfer rates generally increase with the shrink of the obstacle size and with the increase of Rayleigh number. Excellent agreement is obtained with previous results in the literature.

Keywords Finite element method · Natural convection · Heat transfer · Square cavity · Adiabatic obstacle

Mathematics Subject Classification 65M60 · 76D05 · 80A20

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PPM1A Methylation Is Associated With Vascular Recurrence in Aspirin-Treated Patients

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Background and Purpose—Despite great efforts by pharmacogenetic studies, the causes of aspirin failure to prevent the recurrence of ischemic events remain unclear. Our aim was to study whether epigenetics could be associated with the risk of vascular recurrence in aspirin-treated stroke patients.

Methods—We performed an epigenetic joint analysis study in 327 patients treated with aspirin. In the discovery stage, we performed a nested case–control study in 38 matched ischemic stroke patients in whom 450 000 methylation sites were analyzed. Nineteen patients presented vascular recurrence after stroke, and 19 matched patients did not present vascular recurrence during the first year of follow-up. In a second stage, 289 new patients were analyzed by EpiTYPER.

Results—The following 3 differentially methylated candidate CpG sites, were identified in the discovery stage and analyzed in the second stage: cg26039762 (P=9.69×10^{-06}, *RAF1*), cg04985020 (P=3.47×10^{-03}, *PPM1A*), and cg08419850 (P=3.47×10^{-03}, *KCNQ1*). Joint analysis identified an epigenome-wide association for cg04985020 (*PPM1A*; P=1.78×10^{-07}), with vascular recurrence in patients treated with aspirin.

Conclusions—The pattern of differential methylation in *PPM1A* is associated with vascular recurrence in aspirin-treated stroke patients. **(*Stroke*. 2016;47:1926-1929. DOI: 10.1161/STROKEAHA.116.013340.)**

Key Words: aspirin ■ methylation ■ phenotype ■ platelet aggregation ■ stroke

Ischemic stroke patients are at high risk of having new cardiovascular events. The cumulative risk of vascular recurrence after a first stroke reaches up to 48% at 10 years.[1] Acetylsalicylic acid (aspirin) and clopidogrel are the most widely used antiplatelet agents in secondary prevention of stroke. Aspirin has been associated with a relative risk reduction of 25% in secondary cardiovascular events and 13% to 15% in secondary prevention of stroke.[2] A high platelet reactivity phenotype can be present in ≤60% of aspirin-treated patients and has been associated with an increased risk of recurrent ischemic events, and although it is a substantially heritable phenotype, very few genetic determinant have been identified. Furthermore, the causes of aspirin failure goes beyond high platelet reactivity and are still largely unknown.[3]

Only polymorphisms in *PEAR1* have been confirmed as genetic risk factors of aspirin failure.[4] The rs12041331 polymorphism is associated with platelet aggregation, increased platelet reactivity,[5] and vascular recurrence in aspirin-treated patients,[4] although these polymorphisms do not explain the whole variability observed in aspirin resistance or in vascular responsiveness. Other genomic regulations, such as epigenetics modifications could be associated with the risk of vascular recurrence in patients treated with aspirin.

We aimed to analyze the whole epigenome of stroke patients treated with aspirin, to find altered methylation sites associated with vascular recurrence.

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MHD Couette-Poiseuille flow of variable viscosity nanofluids in a rotating permeable channel with Hall effects

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Hall effects

ABSTRACT

Hydromagnetic Couette-Poiseuille flow of variable viscosity nanofluids with heat and mass transfer between two parallel plates in a rotating permeable channel is investigated numerically. The model nonlinear problem which incorporates thermophoresis, Brownian motion, viscous dissipation, Joule heating and Hall effects are obtained and tackled numerically using a fourth order Runge–Kutta–Fehlberg integration scheme with shooting technique. The effects of various thermophysical parameters on nanofluid velocity, temperature, concentration, skin friction coefficient, and Nusselt and Sherwood numbers are discussed thoroughly and analyzed through graphs. The results show that Hall current significantly affects the flow system. Results for some special cases of the present analysis are in good agreement with the existing literature.

Greek symbols

α_f	thermal diffusivity
β	viscosity variation coefficient
δ	variable viscosity parameter
η	dimensionless variable
θ	dimensionless temperature
ϕ	dimensionless concentration
ρ	nanofluid density
μ	dynamic viscosity
υ	kinematic viscosity coefficient
σ	electrical conductivity
T	specific heat capacity ratio
τ_e	electron collision time
τ_1	wall shear stress due to u
τ_2	wall shear stress due to w
ω_e	cyclotron frequency
Ω	angular velocity
Λ	upper wall motion parameter

1. Introduction

The magnetohydrodynamic rotating flow of electrically conducting viscous incompressible fluids has attracted the interest of many investigators in view of its applications in many industrial (in the design of turbines and turbo mechanics), astrophysical (dealing with the sunspot development, the solar cycle and the structure of rotating magnetic stars), geophysical (hydrologists to study the migration of underground water, petroleum engineers to observe the movement of oil and gas through the reservoir), technological and engineering applications (MHD generators, ion propulsion, MHD pumps, etc.) and many other practical applications, that is, in biomechanical problems (e.g., blood, flow in the pulmonary alveolar sheet). It can provide an explanation for the observed maintenance and secular variation of the geomagnetic field [1]. It is also important in the solar physics involved in the sunspot development, the solar cycle and the structure of rotating magnetic stars [2]. The effect of the Coriolis force due to the earth's rotation is found to be significant as compared to the inertial and viscous forces in the equations of motion. The Coriolis and the electromagnetic forces are of comparable magnitude. The Coriolis force exerts a strong influence on the hydromagnetic flow in the earth's liquid core which plays an important role in the mean geomagnetic field. Selvarasu et al. [3] studied the effect of magnetic field on the steady, laminar flow of an incompressible and electrically conducting fluid with mixed convection. The flow and temperature fields for low *Re* was considered. Results show that drag coefficient non-monotonically increases with rising

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ORIGINAL ARTICLE

On generalized fuzzy ideals of ordered $\mathcal{AG}$-groupoids

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Abstract We introduced $(\in_\gamma, \in_\gamma \vee q_\delta)$-fuzzy (left, right, bi-) ideals of an ordered Abel Grassman's groupoids (AG-groupoid) and characterized intra-regular ordered AG-groupoids in terms of these generalized fuzzy ideals.

Keywords Ordered $\mathcal{AG}$-groupoids · Left invertive law · Medial law · Paramedial law · $(\in_\gamma, \in_\gamma \vee q_\delta)$-fuzzy ideals

1 Introduction

The fundamental concept of a fuzzy set was introduced by Zadeh in his classic paper [29], which provides a natural framework for generalizing some of the basic notions of algebra. Kuroki [10] introduced the notion of fuzzy bi-ideals in semigroups. A new type of fuzzy subgroup, that is (α, β)-fuzzy subgroup, was introduced in an earlier paper of Bhakat and Das [3] by using the notions of "belongingness and quasi-coincidence" of fuzzy points and fuzzy sets. The concepts of an $(\in, \in \vee q)$-fuzzy subgroup is a useful generalization of Rosenfeld's fuzzy subgroups [19]. It is now natural to investigate similar type of generalizations of existing fuzzy sub-systems of other algebraic structures. The concept of an $(\in, \in \vee q)$-fuzzy sub-near rings of a near ring introduced by Davvaz in [6]. Kazanci and Yamak [11] studied $(\in, \in \vee q)$-fuzzy bi-ideals of a semigroup. Shabir et al. [20] characterized regular semigroups by the properties of $(\in, \in \vee q)$-fuzzy ideals, fuzzy bi-ideals and fuzzy quasi-ideals. Kazanci and Yamak [11] defined $(\overline{\in}, \overline{\in} \vee \overline{q})$-fuzzy bi-ideals in semigroups. Many other researchers used the idea of generalized fuzzy sets and gave several characterizations results in different branches of algebra. Generalizing the concept of $x_t q f$, Shabir and Jun [21], defined $x_t q_k f$ as $f(x) + t + k > 1$, where $k \in [0, 1)$. In [21], semigroups are characterized by the properties of their $(\in, \in \vee q_k)$-fuzzy ideals.

Faisal and Khan [15] introduced the concept of an ordered $\mathcal{AG}$-groupoid and provided the basic theory for an ordered $\mathcal{AG}$-groupoid in terms of fuzzy subsets. The generalization of an ordered $\mathcal{AG}$-groupoid was also given by Faisal et al. [27] and they introduced the notion of an ordered Γ-$\mathcal{AG}^{**}$-groupoid.

The concept of a left almost semigroup ($\mathcal{LA}$-semigroup) was first introduced by Kazim and Naseeruddin [12] in 1972. In [7], the same structure was called a left invertive groupoid. Protic and Stevanovic [18] called it an Abel-Grassmann's groupoid ($\mathcal{AG}$-groupoid). An $\mathcal{AG}$-groupoid is a groupoid $\mathcal{S}$ whose elements satisfy the left invertive law $(ab)c = (cb)a, \forall a, b, c \in \mathcal{S}$. In an $\mathcal{AG}$-groupoid, the medial law [12] $(ab)(cd) = (ac)(bd), \forall a, b, c, d \in \mathcal{S}$ holds. An $\mathcal{AG}$-groupoid may or may not contains a left identity. The left identity of an $\mathcal{AG}$-groupoid allow us to introduce the inverses of elements in an $\mathcal{AG}$-groupoid. If an $\mathcal{AG}$-groupoid contains a left identity, then it is unique [16]. In an $\mathcal{AG}$-groupoid $\mathcal{S}$ with left identity, the paramedial law $(ab)(cd) = (dc)(ba), \forall a, b, c, d \in \mathcal{S}$ holds. If an $\mathcal{AG}$-

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