UAEU College of Science كلية العلوم

Department of Mathematical Sciences

جامعة الإمارات العربية المتحدة
United Arab Emirates University

قسم علـوم الرياضيـــــات

THE FIFTH INTERNATIONAL CONFERENCE ON MATHEMATICAL SCIENCES

Book of Abstracts

MARCH 21 - 24, 2016

Al-Ain, United Arab Emirates

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Plenary Sessions

THE SOLUTION TO SIEGEL'S PROBLEM ON SMALL VOLUME LATTICES

Gaven J. Martin

Massey University, New Zealand

GROUPOID TECHNIQUES IN MATHEMATICS

Jean Renault

University of Orléans, France

BICATEGORIES, TWO-DIMENSIONAL COHOMOLOGY, GALOIS COOBJECTS, PSEUDOMONOIDS AND TEHBRAUER GROUP

Stephaan Caenepeel

Vrije Universiteit, Belgium

COMPLEX NETWORK OF NEURONAL REACTION-DIFFUSION SYSTEMS: LONG-TIME BEHAVIOR AND SELF-ORGANIZATION

M.A. Aziz Alaoui

University of Le Havre, France

THE SOLUTION TO SIEGEL'S PROBLEM ON SMALL VOLUME LATTICES

Gaven J. Martin

Massey University, New Zealand

Abstract:

We outline in very general terms the history and the proof of the identification of the minimal covolume lattice of hyperbolic 3-space as the 3-5-3 Coxeter group extended by the involution preserving the symmetry of this diagram. This gives us the smallest regular tessellation of hyperbolic 3-space. This solves (in three dimensions) the problem posed by Siegel in 1945 (Siegel solved this problem in two dimensions by deriving the Signature formula identifying the (2,3,7)-triangle group as having minimal co-area). There are strong connections with arithmetic hyperbolic geometry in the proof and the result has applications in the maximal symmetry groups of hyperbolic 3-manifolds (in much the same way that Hurwitz 84g-84 theorem and Siegel's result do).

GROUPOID TECHNIQUES IN MATHEMATICS

Jean Renault

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University of Orléans, France

Abstract:

I will illustrate the usefulness of the notion of groupoid in various areas of mathematics. In the theory of di_erential equations, it is closely related to the notions of flows, foliations and Lie algebroids. In algebra, it goes along with the theory of inverse semigroups. In ergodic theory, it appears under the form of measured equivalence relations and provides crucial notions such as orbit equivalence and Mackey range. In probability theory, it occurs naturally in the theory of random walks. In functional analysis, it provides convenient models for von Neumann algebras and C*-algebras. It is also an important concept in noncommutative geometry.

BICATEGORIES, TWO-DIMENSIONAL COHOMOLOGY, GALOIS COOBJECTS, PSEUDOMONOIDS AND TEHBRAUER GROUP

Stephaan Caenepeel

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Abstract:

Classical results state that the Brauer group of a commutative ring, and the group of Galois objects of a cocommutative Hopf algebra can be interpreted as a second cohomology group. The aim of this talk is to present a unifying theory, and also to present an algebraic interpretation of the third cohomology group. This interpretation involves classification of certain monoidal categories, and is related to the theory of quasi-bialgebras. The well-known 7 term long exact sequence of Chase and Rosenberg will be extended to a 10 term exact sequence.
A Picard groupoid - also termed symmetric cat-group - is a symmetric monoidal groupoid $\mathbb{G}$ such that every object I has an inverse I^* in the sense that $I \otimes I^* \cong k$, the unit object of the category. $\mathbb{G}$ is called restricted if $c_{I,I}$ is the identity on $I \otimes I$, for all I. Here c is the symmetry. Picard groupoids can be viewed as the categorical generalization of abelian groups. Given a complex of abelian groups, we can define a sequence of restricted Picard groupoids. The isomorphism classes in each of these groupoids form an abelian group, and these are the cohomology groups of the complex. This is an elementary observation, but the interesting aspect is that this construction can be pushed to a higher dimension. We can define complexes of restricted Picard groupois, and to such a complex, we can associate a sequence of bicategories. Equivalence classes in each of these bicategories form an abelian group, and these are called two-dimensional cohomology groups.

Complexes of restricted Picard groupoids can be obtained from cosimplicial Picard groupoids. In turn, cosimplicial Picard groupoids can be constructed starting from a commutative bialgebroid A over a commutative k-algebra.. The corresponding cohomology is called the Harrison cohomology of the bialgebroid, and the associated bicategories of cocycles are denoted by $\underline{\underline{Z}}^n(A, \underline{\mathrm{Pic}})$.

Classical results about cohomological interpretation of, for instance, the Brauer group, and the group of Galois coobjects over a commutative Hopf algebra, can be refined to 2-equivalences between certain bicategories and the bicategories of cocycles. For example, the Azumaya algebras split by a faithfully projective extension can be organized into a bicategory, and this bicategory is 2-equivalent to $\underline{\underline{Z}}^2(R \otimes R, \underline{\mathrm{Pic}})$. Passing to equivalence classes, we obtain the well-known theorem that the split part of the Brauer group is isomorphic to the Amitsur cohomology group $H^2(R \otimes R, \underline{\mathrm{Pic}})$.

More generally, have algebraic interpretations of $\underline{\underline{Z}}^n(A, \underline{\mathrm{Pic}})$ for $n = 0, 1, 2, 3$; these are summarized in the following table.

n	$\underline{\underline{Z}}^n(A, \underline{\mathrm{Pic}})$	0-cells	dimension
0	$\mathbb{G}_m(R^{\mathrm{co}A})$	elements	discrete
1	$\underline{\mathrm{Pic}}^A(R)$	invertible A-comodules	category
2	$\underline{\underline{\mathrm{Gal}}}(A)$	Galois coobjects	bicategory
3	$\underline{\underline{\mathrm{PM}}}(A)$	pseudomonoids	bicategory

COMPLEX NETWORK OF NEURONAL REACTION-DIFFUSION SYSTEMS: LONG-TIME BEHAVIOR AND SELF-ORGANIZATION

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Abstract:

After a general introduction on Complex systems, interaction networks and synchronization of dynamical systems, we focus on the long time behavior of complex networks of reaction- diffusion (RD) systems. We prove the existence of the global attractor and a L^{∞}-bound for a network of n RD systems with d variables each. This allows us to prove the identical synchronization for general class of networks and establish the existence of a coupling strength threshold value that ensures such a synchronization. We then apply these results to some particular networks with different structures (i.e. different topologies) and perform numerical simulations. We found out theoretical and numerical heuristic laws for the minimal coupling strength for synchronization relatively to the number of nodes and the network topology, and discuss the link between spatial dimension and synchronization.

Contributed Talks

Algebra, Analysis, Functional Analysis, Number Theory and Topology

SEMIFIELD SPREADS AND BENT FUNCTIONS

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General area of research: Algebra

Abstract:
Semifields are algebras satisfying axioms for fields except (possibly) associativity of the multiplication. Geometrically semifields coordinatize certain translation planes. They induce spreads of some vector spaces. Bent functions are Boolean functions with some optimal properties. We investigate constructions of bent functions related to semifield spreads.

Keywords: Spreads, semifields, oval polynomials, bent functions.

EMBEDDING INTO FINITELY GENERATED ALGEBRAS

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General area of research: Algebra.

Abstract:

Let A be a countably demesnial associative algebra over a filed F. Then there exists a finitely generated algebra S such that the algebra of infinite N × N finitary matrices over A is an ideal of S.

ON (m,n)-CLOSED IDEALS OF COMMUTATIVE RINGS

DAVID F. ANDERSON AND **AYMAN BADAWI**[1]

ABSTRACT. Let R be a commutative ring with $1 \neq 0$, and let I be a proper ideal of R. Recall that I is an n-absorbing ideal if whenever $x_1 \cdots x_{n+1} \in I$ for $x_1, \ldots, x_{n+1} \in R$, then there are n of the x_i's whose product is in I. We define I to be a semi-n-absorbing ideal if $x^{n+1} \in I$ for $x \in R$ implies $x^n \in I$. More generally, for positive integers m and n, we define I to be an (m,n)-closed ideal if $x^m \in I$ for $x \in R$ implies $x^n \in I$. A number of examples and results on (m,n)-closed ideals are discussed in this paper.

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GROUP ALGEBRAS WHOSE GROUPS OF NORMALIZED UNITS HAVE EXPONENT 4

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Abstract:

It is well known that there does not exist a reasonable description of finite groups of prime square exponent p^2 (not even in the case when the exponent is 4). However Z. Janko (see for example [3,4,5]) was able to characterize these groups under certain additional restrictions on their structure. In this way he obtained interesting classes of finite p-groups.

In our talk we give a full description of locally finite 2-groups G such that the normalized group of units $V(FG)$ of the group algebra FG over a field F of characteristic 2 has exponent 4 (see [1], [2]).

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SPECIAL CLASSES OF HOMOGENEOUS SEMILOCAL

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Abstract:

Let be the Jacobson radical of a ring R. A ring R is said to be homogeneous semilocal ring if is simple artinian. The class of homogeneous semilocal rings lies properly between local rings and semilocal rings. The Jacobson radical is a useful tool for understanding the structure of such rings. Main goal of this paper is to transfer of algebraic property, homogeneous semilocal, from corner rings, upper triangular matrices, polynomial rings to the basic ring R.

Keywords: Homogeneous semilocal; corner ring; polynomial rings; upper triangular matrices.

Convergence Groups of K-Quasiconformal Mappings

Jianhua Gong
United Arab Emirates University

Abstract

Convergence groups are introduced by Gehring and Martin in 1987, and have found wide application in Geometric Group Theory and low-dimension Topology and Geometry. Quasiconformal mappings are almost everywhere differentiable mappings on a subdomain of n dimensional extended Euclidean space. They can map infinitesimal circles to infinitesimal ellipses which has the property that the ratio of the major to minor axes is uniformly bounded from above.

We will discuss convergence groups of K-quasiconformal mappings in this talk. Groups here are topological groups of homeomorphisms, each of which is a K-quasiconformal mapping, under composition with respect to the compact–open topology which is equivalent to the topology induced from locally uniformly convergence. A subgroup G is called discrete if the induced topology coincides with the discrete topology.

EXTENSION OF THE GROUP $C(n)$ BY MEANS OF THE DIRECT PRODUCT OF TWO CYCLIC GROUPS OF ORDER p $A=\langle\bar{a}\rangle_p\times\langle\bar{b}\rangle_p$

Prof. Abdullatif Hanono, M.Sc. Dana Saleh

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General area of research: Algebra

Abstract:

These papers reports the investigation of the extensions of the group $C(n)=C_{p^\infty}\oplus C_{p^\infty}\oplus.....\oplus C_{p^\infty}$, where $C_{p^\infty}=\langle a_0,a_1,.....;pa_0=0,pa_1=a_0,....\rangle$ by means of the direct product of two cyclic groups of order p $A=\langle\bar{a}\rangle_p\times\langle\bar{b}\rangle_p$, where p is a prime number.

It has been concluded from this work that all non isomorphic extensions of the group $C(n)$ by means of the group $A=\langle\bar{a}\rangle_p\times\langle\bar{b}\rangle_p$, that correspond to Z_p-irreducible representations of the group $A=\langle\bar{a}\rangle_p\times\langle\bar{b}\rangle_p$, are:

$G(T,0,0,a_0)$ و $G(T,0,0,0)1)$

$G(U,0,\beta,c_0)$ ، $G(U,0,0,0)$ ، $G(U,0,\beta,0)$ ، $G(U,0,0,0)2)$

Where $\beta=(a_0,0,...0)\in C(p-1)$ ، $\beta=(a_0,2a_0,...(p-1)a_0)\in C(p-1)$

Keywords: Extensions, non-isomorphic extensions, and irreducible representations.

ON THE MOENS´ THEOREM FOR NON ASSOCIATIVE ALGEBRAS

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General area of research: Algebra

Abstract:

In 1955, Jacobson proved that a finite-dimensional Lie algebra over a field of characteristic zero admitting a non-singular (invertible) derivation is nilpotent. The problem of whether the inverse of this statement is correct remained open until work of Dixmier and Lister, where an example of nilpotent Lie algebra all of which derivations are nilpotent (and hence, singular), was constructed. For Lie algebras in prime characteristic the situation is more complicated. In that case there exist non-nilpotent Lie algebras, even simple ones, which admit nonsingular derivations (Benkart, Kostrikin and Kuznetsov).
In paper of Moens a generalization of derivations and pre-derivations of Lie algebras is defined as a Leibniz-derivation of order k. Moens proved that a finite-dimensional Lie algebra over a field of characteristic zero is nilpotent if and only if it admits an invertible Leibniz-derivation. After that, Fialowski, Khudoyberdiyev and Omirov proved that a finite-dimensional Leibniz algebra is nilpotent if and only if it admits an invertible Leibniz-derivation. It should be noted that there exist non-nilpotent Filippov (n-Lie) algebras with invertible derivations.
In paper of Kaygorodov and Popov authors showed that the same result holds for alternative algebras (in particularly, for associative algebras). Also, in this article an example of nilpotent alternative (non-associative) algebra over a field of positive characteristic possessing only singular derivations was provided. The main purpose of this talk is to talk about the analogues of Moens' theorem for Jordan, (-1,1)- and Malcev algebras.

Keywords: non associative algebra, Jordan algebra, Malcev algebra

ON MODULES OVER GROUP RINGS OF LOCALLY FINITE GROUPS WITH FINITENESS RESTRICTIONS

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General area of research: algebra

Abstract:

Let A be an **R**G-module, **R** be an associative ring, G be a group. G is a finite-finitary group of automorphisms of A if $C_G(A)=1$ and $A/C_A(g)$ is finite for any $g \in G$ [1]. Finite-finitary groups of automorphisms of A with additional restrictions were studied in [1]. Important finiteness conditions in group theory are the weak minimal condition on subgroups and the weak maximal condition on subgroups. Let G be a group, M be a set of subgroups of G. G is said to satisfy the weak minimal condition on M-subgroups if for a descending series of subgroups $G_0 \geq G_1 \geq G_2 \geq \ldots \geq G_n \geq G_{n+1} \geq \ldots$, $G_n \in M$, $n \in \mathbf{N}$, there is the number $m \in \mathbf{N}$ such that an index $|G_n: G_{n+1}|$ is finite for any $n \geq m$ [2]. Similarly G is said to satisfy the weak maximal condition on M-subgroups if for an ascending series of subgroups $G_0 \leq G_1 \leq G_2 \leq \ldots \leq \leq G_n \leq G_{n+1} \leq \ldots$, $G_n \in M$, $n \in \mathbf{N}$, there is the number $m \in \mathbf{N}$ such that an index $|G_n: G_{n+1}|$ is finite for any $n \geq m$ [3]. These finiteness conditions were applied to investigate infinite dimensional linear periodic groups [4]. Let $L_{nf}(G)$ be the system of all subgroups H of G such that $A/C_A(H)$ is infinite. We say that G satisfies the condition $W_{min\text{-}nf}$ if G satisfies the weak minimal condition on M-subgroups where $M = L_{nf}(G)$ and G satisfies the condition $W_{max\text{-}nf}$ if G satisfies the weak maximal condition on M-subgroups where $M = L_{nf}(G)$.

Theorem 1. Let A be an **R**G-module, **R** be an associative ring, G be a locally finite group. If G satisfies either $W_{min\text{-}nf}$ or $W_{max\text{-}nf}$ then either G is a Chernikov group or G is a finite-finitary group of automorphisms of A.

Let G_σ be the intersection of all normal subgroups K of G such that G/K is soluble.

Theorem 2. Let A be an **R**G-module, **R** be an associative ring, G be a locally soluble periodic group. If G satisfies either $W_{min\text{-}nf}$ or $W_{max\text{-}nf}$ then G/G_σ is soluble.

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Keywords: module, group ring, locally finite group.

ON THE p-LENGTH OF FINITE π-SOLVABLE GROUP WITH GIVEN π-HALL SUBGROUP

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General area of research: algebra

Abstract:

All groups considered in the paper are finite. Let $\boldsymbol{P}$ be a set of all primes, $\boldsymbol{\pi}$ be a subset $\boldsymbol{P}$, $\boldsymbol{\pi' = P \setminus \pi}$, $\boldsymbol{\pi(G)}$ be a set of all prime divides of the order $\boldsymbol{G}$. If $\boldsymbol{G}$ is a group and $\boldsymbol{\pi(G)}$ is a subset $\boldsymbol{\pi}$ then $\boldsymbol{G}$ is called a $\boldsymbol{\pi}$-group, in case $\boldsymbol{\pi(G)}$ is a subset $\boldsymbol{\pi'}$ then $\boldsymbol{G}$ is called a $\boldsymbol{\pi'}$-group.

A group $\boldsymbol{G}$ is called a $\boldsymbol{\pi}$-solvable group if there exists a subnormal series

$$\boldsymbol{E = G_0 \leq G_1 \leq G_2 \leq \ldots \leq G_m = G,}$$

where $\boldsymbol{G_i}$ is a normal subgroup of $\boldsymbol{G_{i+1}}$ and $\boldsymbol{G_i/G_{i-1}}$ is either $\boldsymbol{p}$-factors for $\boldsymbol{p \in \pi}$ or $\boldsymbol{\pi'}$-factors of $\boldsymbol{G_i/G_{i-1}}$ for all $\boldsymbol{i=1,2,\ldots,m}$.

For a group $\boldsymbol{G}$ we can consider a series:

$$\boldsymbol{E = P_0(G) \leq N_0(G) \leq P_1(G) \leq N_1(G) \leq P_2(G) \leq N_2(G) \leq \ldots \leq P_i(G) \leq N_i(G) \leq \ldots,}$$

where $\boldsymbol{N_i(G)/P_i(G)=O_{\pi'}(G/P_i(G))}$, $\boldsymbol{P_{i+1}(G)/N_i(G)= O_{\pi'}(G/N_i(G))}$, $\boldsymbol{i=0,1,2,\ldots}$; $\boldsymbol{O_{\pi'}(X)}$ and $\boldsymbol{O_{\pi}(X)}$ are denoted the lagest normal $\boldsymbol{\pi'}$- and $\boldsymbol{\pi}$-subgroup of group $\boldsymbol{X}$ respectively.

If $\boldsymbol{G}$ is a $\boldsymbol{\pi}$-solvable group then $\boldsymbol{N_k(G)=G}$ for some natural $\boldsymbol{k}$. A smaller natural $\boldsymbol{k}$ with such properties is called the $\boldsymbol{\pi}$-length of $\boldsymbol{\pi}$-solvable group $\boldsymbol{G}$ and denoted by $\boldsymbol{l_\pi(G)}$.

In case $\boldsymbol{\pi=\{p\}}$ we received a $\boldsymbol{p}$-length $\boldsymbol{l_p(G)}$ of $\boldsymbol{p}$-solvable group $\boldsymbol{G}$ introduced by F.Hall and G.Higman in 1956, [1].

Let $\boldsymbol{G}$ be a $\boldsymbol{\pi}$-solvable group in which $\boldsymbol{\pi}$-Hall subgroup $\boldsymbol{G_\pi}$ is non-nilpotent but all own subgroups are nilpotent then $\boldsymbol{l_r(G)=1}$ for all $\boldsymbol{r \in \pi}$ and $\boldsymbol{l_\pi(G) \leq 2}$, [2, theorem 1].

The following theorem is proved in this paper:

Theorem. If $\boldsymbol{G}$ is a $\boldsymbol{\pi}$-solvable group in which $\boldsymbol{\pi}$-Hall subgroup $\boldsymbol{G_\pi}$ is non-supersolvable but all own subgroups are supersolvable then $\boldsymbol{l_p(G)=1}$ for all $\boldsymbol{p>3}$.

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Keywords: finite group, π-solvable group, p-length, $\boldsymbol{\pi}$-length, supersolvable group.

A note on Clean and Neat Rings

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Abstract :

An element x in an associate ring R with identity is called clean if x=e+u where u is an idempotent and u is a unit . Moreover x is strongly clean if, in addition, e u = u e . A ring R is called clean if every element in R is clean and R is called strongly clean if every element is strongly clean. In [1] Yang gave results in the study of strongly clean rings. Earlier to this study; Nicholson and Zhou [2] brought out an up to date many results in the study of clean rings. Later on; McGovern [3] gave a definition of what so called Neat rings. One of the fundamental properties of clean rings is that every homomorphic image of a clean ring is clean. McGrovern [3] defines a neat ring to be one for which every proper homomorphic image is clean . We will give examples of Neat rings which are not clean. In particular, the ring of integers Z is a Neat ring but not clean. A note will be on rings of matrices and a definition for clean rings of polynomials .

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ENUMERATION OF THE PARTITIONS OF AN INTEGER INTO EXACTLY TWO DISTINCT SIZES OF PARTS

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General area of research: Number theory

Abstract:

A partition of a non-negative integer n is a way of writing n as a sum of a non-decreasing sequence of parts.

The present paper provides the number of partitions of an integer n into parts of a specified number of different sizes.

Let $\pi = \left(n_1^{a_1} n_2^{a_2} \dots n_s^{a_s}\right)$ be a partition of n. We say that π is a partition into k parts with s distinct sizes if

$$\begin{cases} n = a_1 n_1 + a_2 n_2 + \cdots + a_s n_s; \\ n_1 > n_2 > \cdots > n_s \geq 1; \\ a_1 + a_2 + \cdots + a_s = k; \\ a_1, \dots, a_s \geq 1. \end{cases}$$

We give a method for constructing all partitions of n into parts of two sizes, as well as an explicit formula to count them with a new self-contained proof. As a side effect, by using the Mobius function. ,We also give a formula for the number of partitions of n into coprime parts. A geometric application is given at the end of this paper.

Keywords: Integer partitions, partitions into parts of two sizes, Divisors number; Mobius function.

ON A SPECIAL KIND OF CONTINUED FRACTIONS AND REAL QUADRATIC NUMBER FIELDS

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General area of research: Number Theory

Abstract:

The aim of this paper is to determine and examine the continued fraction expansions of the form $w_d = \left[a_0; \overline{\underbrace{3,3,\ldots,3}_{\ell(d)-1}, 2a_0} \right]$ where w_d is integral basis element of the real quadratic number fields $Q(\sqrt{d})$ and $l = \ell(d)$ is the period length of w_d for $d \equiv 2,3 \pmod 4$ is a square free positive integer. Moreover, new certain formulas and the lower bound for fundamental unit $\varepsilon_d = \left(t_d + u_d \sqrt{d}\right)/2 \rangle 1$ and Yokoi's d-invariants n_d and m_d will be described for such real quadratic fields. These new formulizations have been unknown yet. Several numerical tables will be also given by using the all results.

Keywords: Continued Fraction, Fundamental Unit, Quadratic Fields, Special Sequence.

FRACTIONAL MAXIMAL FUNCTION ON THE DUAL OF LAGUERRE HYPERGROUP

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General area of research: Analysis

Abstract:

The aim of this presentation is to study the fractional maximal function on the dual of Laguerre hypergroup. The necessary and sufficient conditions on the parameters for the boundedness of the fractional maximal operator on the dual of Laguerre hypergroup from the spaces $Lp($RxN$)$ to the spaces $Lq($RxN$)$ and from the spaces $L1($RxN$)$ to the weak spaces $Lq($RxN$)$ are also discussed.

Keywords: dual of Laguerre hypergroup; Fractional maximal function.

ANALYTIC FUNCTIONS SPACES WITH LAGUERRE KERNELS

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Analysis

Abstract:

We look at a new family of anlytic function spaces based on Laguerre kernels. This family can be used to extend the classical families of Cauchy and weighted Cauchy transforms.

Keywords: analytic function space, Laguerre polynomials, Cauchy transfors.

EXISTENCE OF POSITIVE SOLUTIONS FOR NON-AUTONOMOUS FRACTIONAL DIFFERENTIAL EQUATIONS WITH INTEGRAL BOUNDARY CONDITIONS

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General area of research: Analysis

Abstract:

Integral boundary conditions have various applications in applied fields such as blood flow problems, chemical engineering, theorem-elasticity, underground water flow, population dynamics, and so forth. Boundary value problems with integral boundary conditions and comments on their importance, we refer the reader to the papers [1-4]. In this paper, we investigate existence of positive solutions for a nonlinear fractional differential equations with integral boundary conditions in an ordered Banach space. We use the Caputo fractional differential operator and the nonlinearity depends on the fractional derivative of an unknown function. Guo-Krasnoselskii`s fixed point theorem is the main tool used here to establish the existence.

Keywords: Integral boundary conditions; Green`s function; Guo-Krasnoselskii`s fixed point theorem; Fredholm integral equation.

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TOTALLY REAL PERTURBATIONS AND NON-DEGENERATE EMBEDDINGS OF THE 3-SPHERE

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General area of research: Real Submanifolds of Complex Space

Abstract:

In this presentation, we will discuss the study of complex tangents to real submanifolds of complex space, and the means of perturbations to make such embeddings totally real. In particular, we demonstrate methods for the local removal and modification of complex tangents to embeddings of S^3 into $\mathbf{C^3}$, via the vanishing of a certain homotopy obstruction that we derived. In particular, given any embedding of S^3 and a neighborhood of the complex tangents of the embedding, we show that there exists a (C^0-close) totally real embedding which agrees with the original embedding outside the given neighborhood of the complex tangents. We also demonstrate that given any knot type K in S^3, either there exists an embedding of S^3 which assumes non-degenerate complex tangents exactly along K or there exists a non-degenerate embedding complex tangent along two unlinked copies of K (both cases may hold). We also note possible directions of future investigations.

Keywords: Complex Tangent, Totally Real, Homotopy Obstruction

THE SLICE PROPERTY AND EQUALIZERS OF DIAGRAMS OF C*-ALGEBRAS.

Rachid El Harti

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Abstract:

Let A and B be two C$\sp*$-algebras. For any C$\sp*$-subalgebra $ D$ of B which is equalizer defined by *-homomorphism ϕ_1, ϕ_2 : $ B\longright C $ where C is an other C$\sp*$-algebra. $(A, D. B)$ has the slice property if and only if the tensor product spatial $A\otimes D$ is an equalizer defined by the canonical *-homomorphism $id_A \otimes \phi_1$ and $ id_A \otimes \phi_2$.

COMMUTATIVITY CRITERIA IN BANACH ALGEBRAS

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General area of research: Analysis

Abstract:

In this paper, we use simple algebraic methods and conventional methods of complex analysis to obtain several characterizations for different levels of commutativity in a complex Banach algebra. The extension of the results to wider classes of topological algebras is also considered.

Keywords: Banach Algebra, Commutativity, Radical, Spectral Radius.

WHEN $\left\|A^* \otimes A^+ + A^+ \otimes A^+\right\|_\lambda$ IS MINIMAL ?

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General area of research: Analysis

Abstract:

Let H be a Hilbert space and $B(H)$ the algebra of all bounded linear operators on H . The Moore-Penrose inverse of $A \in B(H)$, denoted by A^+ is the unique solution to the equations

$AA^+A = A,\ A^+AA^+ = A^+,\ (AA^+)^* = AA^+,\ (A^+A)^* = A^+A.$

Notice that A^+ exists if and only if $R(A)$ is closed.

It was proved in [8], that if A is an invertible operator, then the injective norm $\left\|A^* \otimes A^{-1} + A^{-1} \otimes A^*\right\|_\lambda$ in the tensor product space $B(H) \otimes B(H)$, attain its minimal value 2 if and only if A is normal and satisfies the condition $\frac{\gamma}{\eta} + \frac{\eta}{\gamma} \leq 2$, , for every γ, η in the spectrum $\delta(A)$ of A . In this talk, we Shall generalize this results for closed range operators. Also we shall characterize the class of closed range operators for which the equality $\left\|A^* \otimes A^+ + A^+ \otimes A^*\right\|_\lambda = 2$ Holds.

Keywords: Closed range operator, Moore-Penrose inverse, injective norm, partial isometry, normal operator, EP operator, operator equality.

COMMON FIXED POINT RESULTS FOR (α,β)-ADMISSIBLE MAPPINGS OF A GENERAL TYPE CONTRACTION IN b −METRIC SPACES

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General area of research: Analysis

Abstract:
In the present paper; we introduce the notion of A_{φ}_cyclic (α,β)-contractions and give some common fixed point results for mappings satisfying these contractions in the context of b −metric spaces. The results presented here are extend, generalize and improve many existing results in the literature.

Keywords: common fixed points, A_{φ}_cyclic (α,β)-contractions, b −metric spaces.

ON GENERALIZED IDEAL DOUBLE STATISTICAL CONVERGENCE IN TOPOLOGICAL GROUPS

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General area of research: Analysis

Abstract: In many branches of science and engineering we often come across double sequences,i.e. sequences of matrices and certainly there are situations where either the idea of ordinary convergence does not work or the underlying space does not serve our purpose. Therefore to deal with such situations we have to introduce some new type of measures which can provide a better tool and suitable frame work. In this paper, we introduce new notion, namely, ideal λ-double statistical convergence in topological groups . We mainly investigate some inclusion relations between ideal double statistical and ideal λ-double statistical convergence

Keywords: I- double statistical convergence, ideal λ-double statistical convergence,

MAXIMAL NONDISCRETE FUZZY TOPOLOGIES

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General area of research: Topology

Abstract:
A topology *T* of a set *E* is called maximal non-discrete topology if whenever a topology *T'* of *E* strictly contains the topology *T*, then *T'* is necessarily the discrete topology. We investigate in this work maximal non-discrete fuzzy topologies and establish several results related to the structures and cardinalities of such topologies.

Keywords: Fuzzy topology, maximal non-discrete topology.

COUPLED FIXED POINT THEOREM IN C*-ALGEBRAS VALUED METRIC SPACES

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General area of research: Topology and Functional Analysis

Abstract:

In the real valued metric space, replacing the set of real numbers by the positive cone C*-algebra, the set of positive elements on the C*-algebra. We will get C*-algebra valued metric space. We will study the coupled fixed point theorem in this metric and give some related examples to support this idea.

Key Words: Cone Metric Spaces, C*-algebra, Fixed Point Theory.

TWISTED GENERALIZED COHOMOLOGY

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General area of research: Topology and Geometry

Abstract:

Cohomology is an important concept for extracting certain nontrivial information in vector spaces and modules arising in various areas of mathematics as well as in applications to physics. One of the simplest examples is de Rham cohomology in the context of differential forms. I will describe generalizations of this leading to the notion of generalized cohomology theories. These can be twisted to include more topological information and also differentially refined to include geometric information, leading yet to other generalizations which I will also describe. Applications are abundant and I will mention a few.

Keywords: Cohomology, homotopy, differential forms, bundles.

ON LOWER DECKER SETS AND PSEUDO-CYCLES OF SURFACE-KNOT DIAGRAMS

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Abstract:

A surface-knot is a closed oriented surface embedded in 4-space. A surface-knot diagram of a surface-knot is the projected image in 3-space under the orthogonal projection with crossing information. The pre-image of multiple point sets of a surface-knot diagram is called a double decker set that is the union of lower and upper decker sets. The lower decker set induces a rectangular-cell complex. We define pseudo-cycles in the complex. In this talk, we introduce some results from the work with A. Mohamad and some applications of pseudo-cycles.

ON SOFT WEAK STRUCTURES

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c Department of Mathematics, Faculty of Science, Taif University, El-Taif, Hawai, Saudi Arabia**.**

General area of research: Topology

Abstract:

This paper takes some investigations on soft weak structures which are a generalization to weak structures and soft topological spaces with some separation axioms and compact-ness. Also, we give a systematic discussion on the relationship among these notions.

Keywords: soft set; soft weak structure.

Applied Mathematics, Biomathematics, Computational Fluid Dynamics, Financial Mathematics, Mathematical Modeling (in Environmental Sciences), Numerical Analysis, Operations Research, Other Areas of Mathematics

GLOBAL EXISTENCE AND UNIQUENESS OF SOLUTIONS TO A NONLINEAR PARABOLIC SYSTEM

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General area of research: Applied mathematics

Abstract:

Our aim is to prove existence and uniqueness of a global solution to a nonlinear chemotaxis system with degenerate diffusion. We prove existence of local in time solutions by using Schauder's fixed point theorem. Then we provide uniform bounds of the solution leading to the global in time of the solution.

Keywords: Nonlinear Parabolic Systems, chemotaxis, reaction-diffusion.

EXACT SOLUTION OF TIME-FRACTIONAL PARTIAL DIFFERENTIAL EQUATIONS USING LAPLACE TRANSFORM

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General area of research: Applied Mathematics and Analysis.

Abstract:

The idea of replacing the first derivative in time by a fractional derivative of order α, where $0 < \alpha \leq 1$, leads to a fractional generalization of any partial differential equations of integer order. In this paper, we obtain a relationship between the solution of the integer order equation and the solution of its fractional extension by using the Laplace transform method.

Keywords: Abel's integral equation, Caputo's fractional derivative, Laplace transform.

THE LEPTONIC PAIR PRODUCTION IN THE PHOTON INTERACTION WITH ELECTROMAGNETIC FIELD OF LIGHT NUCLEI

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General area of research: Applied Mathematics

Abstract: The analytical and numerical calculations for the problem of photoproduction of (lepton-anti lepton)- pairs in the electromagnetic field of light nuclei has been done. applying the obtained formulae for the energy distribution of the pair-production process to the cases of e^-e^+ , $\mu^-\mu^+$, -pairs in ultra relativistic regions of incident photon energy. and $\tau^-\tau^+$ .Comparing the results for the different cases of pair - production , we can show that the cross-sections for the $\tau^-\tau^+$ - pair due to the electric and magnetic fields of the target nucleus are larger than that for the e^-e^+ and $\mu^-\mu^+$ - pairs , and that the magnetic field of target nucleus is more effective than the electric field of the nucleus in the e^-e^+ , $\mu^-\mu^+$, and $\tau^-\tau^+$ - pair production processes. We can also show that the values cross-sections of the processes due to the electric quadrupole and magnetic octupole of the target nucleus are larger than the values of the cross-sections due to the electric charge distribution and the magnetic dipole moment of the target nucleus in the three cases of the pair-production processes.

Keywords: photoproduction of lepton pairs, lepton pair production in nuclear field.

SOLVING THE STURM-LIOUVILLE PROBLEMS USING THE MODIEFIED TAYLOR SEREIS METHOD

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Abstract:
Several numerical techniques are available to solve boundary value problems. These methods include the shooting method and the finite difference method. Very little is known in the literature about finding an analytical solution for boundary value problems.
Series method is one way used to estimate the analytical solution for these kinds of problems. The Homotopy analysis method has been used to solve the second order Sturm-Liouville eigenvalue problem. An implicit relation $\emptyset(\hbar, \lambda)$ between the eigenvalue λ and the error control parameter $\hbar$ was found. In this article we will use the modified Taylor series method to solve the second order Sturm-Liouville eigenvalue problem. The series will be used to find the eigenvalues and the series expansion of the corresponding eigenfunction.

REGULARISATION OF SOME CLASS OF ILL POSED PROBLEMS

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General area of research: APPLIED MATTHEMATICS

Abstract:

We study an abstract parabolic Cauchy problem associated with an unbounded self-adjoint positive operator which has a continuous spectrum. It is well-known that such a problem is severely ill-posed; that is, the solution does not depend continuously on the Cauchy data. We propose two spectral regularization methods to construct an approximate stable solution to our original problem. Finally, some other convergence results including some explicit convergence rates are also established under a priori bound assumptions on the exact solution.

Keywords: quasi-boundary value method, ill-posed problems.

APPROXIMATE ANALYTICAL SOLUTIONS OF SEMI-EXPLICIT HIGHER-INDEX DIFFERENTIAL ALGEBRAIC EQUATIONS BY ADOMIAN DECOMPOSITION METHOD

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General area of research: Applied mathematics

Abstract:

The purpose of this paper is to propose a novel approximation technique based on the Adomian decomposition method to solve nonlinear semi-explicit higher-index DAEs efficiently. The main advantage of our technique is that; firstly it leads to a simple general algorithm that avoids pre-processing complex transformations like index reductions. Secondly, it requires solving only linear algebraic systems with a constant coefficient matrix at each iteration, except for the first iteration where the algebraic system is nonlinear (if the DAE is nonlinear with respect to the algebraic variable). The developed technique is straightforward and can be programmed in Maple or Mathematica to simulate real application problems. To illustrate the effectiveness of this technique and its advantages, some examples are given.

Keywords: Differential-algebraic equations, Adomian decomposition method, Analytical approximation methods.

LINEAR STABILITY ANALYSIS OF MAGNETOHYDRODYNAMIC RICHTMYER-MESHKOV INSTABILITY IN CYLINDRICAL GEOMETRY

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General area of research: Applied Mathematics.

Abstract:
Numerical simulations and analysis in Cartesian slab geometry for nonlinear ideal magnetohydrodynamics (MHD) indicate that the Richtmyer-Meshkov instability (RMI) is suppressed in the presence of a magnetic field. An analytical solution of incompressible 2-D MHD RMI of an impulsively accelerated interface was investigated by Wheatley et al. (2005) who found that, for a finite magnetic field, although the initial growth rate of the interface is unaffected by the presence of magnetic field, the late-time amplitude of the interface asymptotes to a constant value. In the framework of incompressible MHD, an analytical examination for the behavior of an impulsively accelerated interface separating conducting fluids of different densities in cylindrical geometry will be presented (Figure 1). We investigate the stability properties of such a system and study the influence of the magnetic field on the growth rate of the interface. In converging cylindrical geometry, the RMI is followed by a Rayleigh-Taylor (RT) phase. Our analysis does not account for the RT phase of the instability but is valid for the duration of the RMI phase. We compare results of the incompressible analysis with linear compressible MHD simulations.

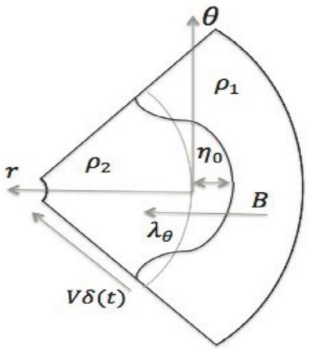

Figure 1: Physical set-up.

Supported by the KAUST Office of Competitive Research Funds under Award No. URF/1/2162-01.

Keywords: Richtmyer-Meshkov instability, magnetohydrodynamics, cylindrical geometry.

References

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V. Wheatley, D. I. Pullin and R. Samtaney, Suppression of the Richtmyer-Meshkov instability in the presence of a magnetic field. J. Fluid Mech. **552**:179-217, 2005.

IDENTIFICATION OF UNKNOWN DATA IN ONE PHASE INVERSE STEFAN PROBLEM

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General area of research: Applied Mathematics

Abstract:

The classical Stefan model is a free boundary problem that represents thermal processes in phase transitions just by accounting for heat-diffusion and exchange of latent heat. It is an important subject studied by many authors. In case the space-dimension is one, there are numerous results concerning existence, uniqueness, stability, and asymptotic behavior of the solution.

The inverse problems for Stefan problem consist of stating the boundary conditions, thermophysical properties of the body or initial conditions. The insufficiency of input information is compensated by some additional information on the effects of the input conditions. In this paper, the additional information is the temperature condition on the fixed face x=0.

Keywords: Stefan problem, free boundary problem, optimal control, inverse problem.

References:

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OPTIMAL CONTROL OF SWITCHED SYSTEMS - A POLYNOMIAL APPROACH

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General area of research:- Applied Mathematics

Abstract:

Switched systems are systems that model phenomena whose dynamics is controlled by a continuous control signal(s). An optimal control problem for a switched system is the problem of finding the optimal trajectory of a constrained switched system. In this talk we present a polynomial approach based on the theory of moments for solving optimal control problems for nonlinear switched systems. The main idea is to transform the nonlinear switched system into an equivalent non-switched system using polynomial representation. Then the method of moments is used to convexify the new control variable to obtain semidefinite programs (SDP) which can be solved by SDP solvers. An important application of optimal control switched system in the modeling of epidemics will be discussed.

Keywords: Switched Systems, Method of Moments, Semidefinite Programs.

ON TOMOGRAPHY WITH LIMITED DATA

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General area of research: Applied mathematics

Abstract:
Moment properties of the Radon transform are reviewed. Approaches to reconstruct the image from the projections within a limited range are summarized. An improvement to the *image moment method* is introduced. In fact, we estimate an unknown projection through its Fourier-Legendre series. The given projections along with the estimated ones can then be used to reconstruct the image. Numerically, our approach is validated by MATLAB experiments.

Keywords: *Radon Transform, Moments, Tomography*

Related Publications

- **On Tomography with Unknown Orientation.** Journal of Mathematical Sciences & Computer Applications 2 (2): 125–136, 2015 doi: 10.5147/jmsca.2015.0178
- **Linear Transformation Recognition Using Radon Transform**, Journal of Mathematical Sciences & Computer Applications 2011
- ***On SPECT, Mathematical Principles, and Historical Remarks,*** The UMAP Journal of Undergraduate Mathematics and Its Applications, vol.29.4, 2009.
- ***Identification of Reflected, Dilated, Translated, and Rotated Objects from their Radon Projections,*** with David Kammler, in IEEE Trans. Image Process. Vol.17, No.3, March 2008.
- ***The Mathematics of Medical X-ray Imaging,*** in UMAP/ILAP Modules: Tools for Teaching, 87–130. Bedford, Mass.: COMAP, 2006.

Exact solution of linear integro-differential equations with weakly singular kernel by using Taylor expansion method

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[b]Department of Mathematics, Univ. 8 Mai 1945 Guelma, P.O.Box 401, 24000 Guelma-Algeria.

Abstract

In this paper, we apply Taylor's approximation and then transform the given nth-order weakly singular linear Volterra and Fredholm integro-differential equations with into an ordinary linear differential equation. Some different examples are considered the results of these examples indicated that the procedure of transformation method is simple and effective, and could provide an accurate approximate solution or exact solution.

Keywords: General Abel Integral, Integro-differential Equations, Weakly singular Fredholm integral-equations, Weakly singular Volterra integral-equations.
2010 MSC: 45A05, 32A55, 34A25, 65T60.

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PHONON SPECTRAL DENSITY AND GENERAL NON-MARKOVIAN DYNAMICS OF THE FMO LIGHT-HARVESTING COMPLEX USING ASSOCIATED, GENERALIZED AND EXCEPTIONAL JACOBI POLYNOMIALS

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General area of research: Applied Mathematics

Abstract:

Energy transfer systems like Fenna-Matthews-Olson (FMO) complex shows quantum coherence between sites of Bacteriophylla molecules in protein environment. In this paper we consider phonon spectral density (PSD) of protein environment in FMO complex and a simple structure of mapping the environment of an open quantum system onto infinite chain representations with nearest neighbor interactions using associated, generalized and exceptional Jacobi polynomials

Keywords: Exceptional Orthogonal Polynomials, Associated and generalized jacobi polynomials, FMO light-harvesting

GLOBAL EXISTENCE AND ASYMPTOTIC BEHAVIOR FOR SOLUTION OF REACTION DIFFUSION SYSTEMS

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General area of research: Applied Mathematics

Abstract:

We prove here global existence and asymptotic behavior of classical solutions for reaction–diffusion systems, we are going to suppose that *f* the second member of system verifies a weaker condition to demonstrate the global existence, and then we are going to study the asymptotic behavior of this solution

Keywords: global existence, asymptotic behavior, semi-groups, operator m-accretif.

TRANSFORMATION EQUATIONS FOR THE FIFTH DIMENSION

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Abstract:
Scientists have been arguing for a long time if there are particles faster than the speed of light or not. Those who denied the existence of particles faster than light speed always refer to Lorentz equation. This equation deals with particles in only four dimensions. In this paper, we show what would happen if we add one more dimension to this equation to make it deals with five dimensions instead of four. The addition of this fifth dimension will greatly help us understand the state of particles before, near, at, and above the speed of light.

NUMERICAL STUDY OF FREE SURFACE FLOW UNDER A SLUICE GATE

Abdelkrim Merzougui, Abdelkader Laiadi

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General area of research: Applied Mathematics

Abstract:

We consider a steady two-dimensional free surface flow under an inclined gate with the effects of both gravity and surface tension in water of a constant depth. The fluid is assumed to be inviscid, incompressible and the flow is irrotational. The problem is characterized by three parameters: the Froude number F, the Weber number α and the gate inclination γ. The problem is solved numerically by a boundary element method derived from an integral equation along the free surface. When the upstream free surface separates tangentially from the gate, the so-called smooth attachment, it is found that there exist solutions for values of gate inclination and other two parameters in this problem.

We consider a steady two-dimensional free surface flow under an inclined gate with the effects of both gravity and surface tension in water of a constant depth. The fluid is assumed to be inviscid, incompressible and the flow is irrotational. The problem is characterized by three parameters: the Froude number F, the Weber number α and the gate inclination γ. The problem is solved numerically by a boundary element method derived from an integral equation along the free surface. When the upstream free surface separates tangentially from the gate, the so-called smooth attachment, it is found that there exist solutions for values of gate inclination and other two parameters in this problem.

Keywords: Free surface flow, surface tension, inclined gate, Weber number, Froude number.

PRACTICAL ASPECTS OF DOING FOURIER TRANSFORMATION ON ACOUSTIC SIGNALS USED FOR FOOD QUALITY DETERMINATION

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General area of research: Applied Mathematics; Cross-disciplinary areas of Mathematics

Abstract:
This paper is dealing with some practical aspects of performing Fourier transform on acoustical signals taken for food quality determination. Food quality in this work is determined by finding the maturity stage of the product. It is well known that acoustic impulse response of a product after applying small non-destructive deformation to the product depends on the elastic (stiffness) property of the product that is in direct correlation with the maturity stage. The analog acoustic response signals are collected by microphones or piezoelectric sensors in gentle contact with the investigated product. The signals are then converted to digital (discrete) amplitude - time forms that are further transformed to power-frequency form by performing Fourier transformation. The main frequency of vibration (the peak) obtained from the power-frequency form of the acoustic response signal, the vicinity of the peak and its half-peak width are giving information on the elastic properties of the investigated product. In order to perform reliable Fourier transformation that will give true information about the elastic properties of the product, several practical aspects have been discussed : 1) signal sampling rate; 2) data acquisition principles; 3) signal sampling resolution; 4) signal cutting; 5) possible influence of acoustic echoes on the signal taken and been transformed; 6) the way of averaging the amplitude-time function and how this influences the power-frequency distribution obtained after the Fourier transformation; 7) the way sensors are positioned around the product and how this influences the signals and forms. In this paper, many examples from the author's own research in the field of food physics have been given and discussed in the above mentioned practical aspects. The mathematics of the Fourier transformation behind the experimental (practical) work on food quality determination by acoustic impulse response method has been explained that is appropriate for a level of postgraduate or PhD studies.

Keywords: Fourier transformation; digital signal processing; function averaging; food physics

DETERMINATION OF STABLE AND UNSTABLE REGIONS OF MATHIEU EQUATION USING THE HOMOTOPY PERTURBATION METHOD

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General area of research: Applied Mathematics

Abstract:

Mathieu equation is a well-known differential equation in which the excitation term appears as the non-constant coefficients. In this paper, the stable and unstable regions of Mathieu equation are determined using the homotopy perturbation method. The transition curves are determined for three cases of linear and nonlinear equations. The results show that the transition curves of linear Mathieu equation depend on frequency of excitation term, however for nonlinear equation, the curves depend also on the initial conditions.

Keywords: Mathieu equation, homotopy perturbation, stable region, parametric excitation.

Robust Stability Analysis of a Delayed Inertial Neural Network

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General area of research: Applied Mathematics

Abstract:

The stability performance of dynamical systems can be compromised by unavoidable parameter uncertainties. This is due to the existence of modeling errors, external disturbance, and parameter fluctuations. In this study, the robust stability analysis of a delayed inertial neural network using the Lyapunov stability theory and Linear Matrix Inequality (LMI) method is examined. Based on a suitable variable transformation, an inertial neural network with time delays consisting of second-order differential equations can be converted into a first-order differential model. The sufficient conditions of the delayed inertial neural network are derived by constructing suitable Lyapunov functional candidates, introducing new free weighting matrices, and utilizing the Writinger-type integral inequality. Through the LMI solution, the resulting delayed inertial neural network shows globally asymptotically stable behaviors. A numerical example is presented to demonstrate the effectiveness of the derived analytical results.

Keywords: Neural networks, Lyapunov stability theory, linear matrix inequality

BIO-INSPIRED COMPUTATIONAL INTELLIGENCE HYBRIDIZED WITH INTERIOR POINT METHOD TO STUDY NONLINEAR VAN DER POL HEARTBEAT DYNAMICS MODEL

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Abstract: In this study, biologically inspired computational intelligence algorithm is exploited to obtain an approximate solution of model of heart based on nonlinear oscillatory Van-der Pol (VdP) equation using feed forward artificial neural networks (FF_-ANNs), Genetic Algorithms (GAs) integrated with Interior-Point Algorithm (IPA). The mathematical modeling of the system is performed by FF-ANNs by defining an unsupervised error and unknown weights the networks are tuned globally with GAs and local refinement of the results is made with IPA. Design scheme is applied to study the VdP heart dynamics model by varying the pulse shape modification factor, damping coefficients and external forcing factor while fixed value of ventricular contraction period. The results of proposed algorithm are compared with reference numerical solutions of Adams method to establish its correctness. Monte Carlo simulations are performed for the scheme and results of statistical analyses in terms of mean absolute deviation, root mean square error and Nash-Sutcliffe efficiency illustrate its applicability, effectiveness and reliability.

Keywords: Model of heart; Artificial Neural Networks; Van Der Pol oscillators; Interior point methods; Genetic algorithms; Hybrid Computing

ANISOTROPIC UNIVERSE SPACE-TIME NON-COMMUTATIVITY AND APPLICATION TO PHYSICAL SYSTEMS

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General area of research: Applied Mathematics

Abstract:

We study the effect of the non-commutativity on the creation of scalar particles from vacuum in the anisotropic universe space-time. We derive the deformed Klein-Gordon equation up to second order in the non-commutativity parameter using the general modified field equation. Then the canonical method based on Bogoliubov trans-formation is applied to calculate the probability of particle creation in vacuum and the corresponding number density in the k mode. We deduce that the non-commutative space-time introduces a new source of particle creation.

Keywords: Non-commutative field theory, Bogoliubov transformation, Particle production.

STATISTICAL METHODS FOR MULTINOMIAL OF ORDINAL DATA

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General area of research: Biomathematics

Abstract:

The modeling of multinomial ordinal data is an important Domain of developments' in epidemiology. More generally, the ordinal scales are frequent used in epidemiology and clinical research to evaluate dimensions such as quality of life, illness, depression. In this context statistical Methods for multinomial of ordinal data are described and compared, they will be interpreted in terms of distribution of the dependent variable and show how they allow search of differential effects of factors on the stages of the consumption of alcohol. The longitudinal study of alcohol consumption among adolescents and psycho sociological research of risk factors is a crucial issue of Public Health.

Keywords: *Statistical, Methods, multinomial, ordinal data, logit cumulatif, odds proportional.*

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A REVIEW OF TWO EFFICIENT COMPUTATIONAL PROCEDURES FOR THE DETERMINATION OF THE BASIC REPRODUCTION RATIO IN INFECTIOUS DISEASE MODELS

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General area of research: Biomathematics

Abstract

The basic reproduction number R_0 is the number of secondary cases which one case would produce in a completely susceptible population. It depends essentially on the duration of the infectious period, the probability of infecting a susceptible individual during one contact, and also the number of new susceptible individuals contacted per unit of time. Therefore R_0 may vary considerably for different infectious disease, but also for the same disease in different populations. The key threshold result of epidemic theory associates the outbreaks of epidemics and the persistence of endemic levels with basic reproduction number greater than one ($R_0 > 1$). Because the magnitude of R_0 allows one to determine the amount of effort which is necessary either to prevent an epidemic or to eliminate an infection from a population, it is important to estimate R_0 for a given disease in a particular population. In this work we surveyed the computational procedures in determining the basic reproduction ratio for infectious disease models. We made a comparison between the next generation matrix method and graphical method. A number of illustrated examples shows that with any of the two methods used in computing R_0, we obtain the same result. However, the graphical method appears faster and more efficient.

Keywords: Basic reproduction number, epidemic, next generation matrix, graphical method.

THE EFFECTS OF HUMAN POPULATION MOVEMENTS TO MALARIA SPREAD IN KENYA

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Abstract:
Malaria is an infectious disease caused by parasites that can be transmitted by mosquitoes. Malaria remains one of the major killers of humans worldwide, threatening the lives of more than one third of the world's population. In particular, Kenya in Africa is one of the malaria endemic countries. In fact, 25 million out of a population of 34 million Kenyans are at risk of malaria. Thus, reducing malaria morbidity and fatality rate is one of the country's major public health targets. Due to rapid urbanization in Kenya, informal urban settlements are expanded, and environmental degradation is accelerated, which leads to increase of malaria. Moreover, such urbanization has been causing a large volume of human population movements from place to place for work, education, or farming. This factor also contributes to the rapid malaria distribution in the whole country. Thus, we investigate types of human population movements in Kenya and their effects on the malaria spread to establish a strategy of prevention of malaria in Kenya.

OPTIMIZATION OF VACCINATION AND TREATMENT IN INFLUENZA INFECTION

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General area of research: Biomathematics, Applied Mathematics, Optimization

Abstract:

A deterministic model, in the form of a system of ordinary differential equations, is presented, that describes the influenza virus transmission dynamics in the presence of treatment and vaccination in a human population. The model is used to determine an optimal vaccine distribution for influenza virus pandemic in the United States by evaluating all possible age-based vaccination and treatment policies. This is achieved by determining the optimal age-specific distribution of a limited number of vaccine and treatment doses for five different outcome measures: contingent valuation, cost, mortality, morbidity, and years of life lost.

Keywords: Influenza, Ordinary differential equations, Optimal Control, constrained optimization by linear approximation method

IMAGE RETRIEVAL USING ITERATIVE ALGORITHM

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General area of research: Biomathematics, Computational Mathematics

Abstract:

Obtaining high resolution images with an enhanced contrast is often a challenge in the field of microscopic imaging. This is due to the fact that the resolution is often limited by the diffraction and the quality of the optical system used in the imaging process. Since manufacturing such perfect optical systems are costly and practically impossible, a numerical reconstruction of the image is adopted which would replace complicated optical systems. This is done by first recording the diffracted intensity of the specimen by a charge-coupled device array and then inverting it to reconstruct the image of the specimen using certain iterative phase retrieval algorithms. This also requires the use of certain constraints corresponding to the measurements taken and a prior knowledge of the system. Modifications are also suggested in the algorithm while the objects are weakly scattering or the illumination is of very high intensity. This has enhanced the contrast and the edge detection in the existing imaging techniques.

Keywords: Diffraction, imaging, ptychography.

PATTERN FORMATION FOR A PREDATOR-PREY MODEL WITH HOLLING TYPE II FUNCTIONNAL RESPONSE AND CROSS-DIFFUSION.

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General area of research: Biomathematics

Abstract:

This paper deals with a predator-prey model with modified Leslie-Gower and Holling type II functional response and cross-diffusion in a bounded domain with Neumann boundary condition. By using the bifurcation theory, the conditions of Hopf and Turing bifurcation critical line in a spatial domain are obtained. We carry out some numerical simulations in order to support our theoretical results and to interpret how biological processes affect spatio-temporal pattern formation which show that it is useful to use the predator-prey model to detect the spatial dynamics in the real life.

Keywords: Reaction-diffusion systems, cross-diffusion, pattern formation, Turing instability.

INVESTIGATION OF FLOW PAST A CIRCULAR CYLINDER UNDERGOING FIGURE-EIGHT-TYPE MOTION

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General area of research: Applied Mathematics - Computational Fluid Dynamics

Abstract:

This study aims to investigate the two dimensional flow of a viscous incompressible fluid past a circular cylinder undergoing figure-eight-type motion using the two-dimensional Nervier-Stokes equations at a fixed Reynolds number $R = 185$. The Fourier spectral method together with finite difference approximation is used to solve the two-dimensional Navier-Stokes equations in non-primitive variables. The numerical simulations show the existence of different types of asymmetric modes of vortex formation in the cylinder wake at different values of unsteady loading on the cylinder, which is characterized by the ratio of excitation frequency f , to Karman shedding frequency f_0 . The influence of these modes of vortex shedding on the hydrodynamic forces acting on the cylinder surface is also discussed

Keywords: Unsteady flow; Vortex formation; Lock-on; figure-eight-type motion.

A FAMILY OF SYMMETRIC DISTRIBUTIONS WITH APPLICATION TO NORMAL DISTRIBUTION

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Abstract:
Statistical distributions are commonly applied to describe real world phenomena. Due to the usefulness of statistical distributions, their theory is widely studied and new distributions are developed. The interest in developing more flexible statistical distributions remains strong in statistics profession. In this talk, we present a symmetric family of generalized normal distributions. The motivation of this work is to introduce a flexible family of distributions that can be applied to model both heaver and lighter tails than the normal one. We study in some details a member of the proposed family namely, the logistic-normal distribution. For illustration purposes, we apply the logistic-normal distribution to model various data sets with heavier and lighter tails than the normal distribution.

Keywords: Normal distribution; logistic distribution; *T-X* family; quantile function.

ON THE OPTIONS PRICING IN ILLIQUID MARKETS WITH JUMPS- A NUMERICAL APPROACH

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General area of research: Financial Mathematics

Abstract:

In this paper, we deal with the option-pricing problem in illiquid market with jumps. We consider an underlying asset price process driven by a Brownian motion and an independent compensated Poisson process. The market, in this case, is incomplete and a closed form solution to the option-pricing problem is no more assured. Nevertheless, we can express the value of an option as an expectation using the risk neutral theory. Accordingly, we simulate the underlying asset price process using Euler scheme for stochastic differential equations. Then, the Monte Carlo method is employed to evaluate numerically the expectation of the European option price. Illustrative figures for the underlying asset price and for European options prices are provided.

Keywords: Numerical simulations, illiquid markets, jump-diffusion models, incomplete markets, European options, Monte Carlo method.

VALUATION OF CURRENCY OPTIONS IN MARKETS WITH A CRUNCH

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General area of research: Financial Mathematics

Abstract:

This work studies the valuation of currency options in markets suffering from financial crisis. We consider a European option where the underlying asset is a foreign currency. We assume that the value of the underlying asset is a stochastic process that follows a modified Black-Scholes model with an augmented stochastic volatility. Under these settings, we derive formulas for the option-pricing problem on foreign currency for European call and put. Moreover, we compute the different price sensitivities explicitly. An application is also provided.

Keywords: Currency options, European options, financial crisis, Black-Scholes model.

EVALUATING OPTIONS UNDER A HYBRID STOCHASTIC VOLATILITY MODEL- A NUMERICAL APPROACH

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General area of research: Financial Mathematics

Abstract:

Options pricing is the study of the pricing of contracts made today to buy an asset at a future date at a specified price and these are otherwise known as derivatives. Fischer Black and Myron Scholes came up with the famous Black-Scholes formula (see [1]) that assumed that the price of the underlying asset (S_t), follows a log-normal distribution that is to say $\ln(S) \sim N(\mu,\sigma)$ where μ and σ are constants. Stochastic volatility however, is the study of the same problem where the volatility, which is usually represented by the variance, is assumed to be a stochastic variable. Two of the most popular stochastic volatility models are the Heston Model and the CEV model. In this paper we numerically simulate a hybrid stochastic volatility model. This hybrid model takes the strengths of the Heston and the CEV models and we aim to compare the efficiency of the models. Numerical simulation of the asset price using the Euler scheme and the Euler-Maruyana scheme are done while the price of the European call option under the hybrid stochastic volatility model is simulated using the Monte Carlo method. Several graphs of the solutions are given.

Keywords: Numerical simulations, European options, Monte Carlo method, Stochastic volatility

References:

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SMOOTHING SPLINE ESTIMATOR OF THE REGRESSION FUNCTION WITH TWICE CENSORED DATA

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General area of research: Other Areas of Mathematics

Abstract:

Let X be a random vector, let Y be a bounded random variable and let R and L be two censoring random variables. Our goal is to construct smoothing Spline estimate of the regression function E(Y |X = x) when Y is twice censored. Namely Y is censored on the right by R and L is a left censoring variable operating on min(Y; R). We establish that the mean squared errors of the proposed estimator converge to the optimal value almost surely. This investigation extends the results available for Y only right censored.

Keywords: Regression function, Smoothing Spline, product limit estimator, twice censored data, the mean squared errors.

A BASIS FOR IMPROVING NUMERICAL WEATHER PREDITION USING DOPPLAR RADIAL WINDS

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General area of research: Mathematical Modeling in Environmental Sciences

Abstract:

This contribution presents a theoretical framework to Data Assimilation of Doppler Radial Winds into a high resolution NWP model using 3D-Var system. NWP is considered as an initial-boundary value problem: given an estimate of the present state of the atmosphere, the model simulates (forecasts) its evolution. Specification of proper initial conditions and boundary conditions for numerical dynamical models is essential in order to have a well-posed problem and subsequently a good forecast model (A well-posed initial/boundary problem has a unique solution that depends continuously on the initial/boundary conditions). The goal of data assimilation is to construct the best possible initial and boundary conditions, known as the analysis, from which to integrate the NWP model forward in time. We discuss the types of errors that occur in radar radial winds. Some related problems such as nonlinearity and sensitivity of the forecast to possible small errors in initial conditions, random observation errors, and the background states are also considered. The technique can be used to improve the model forecasts, in the Gulf area, at the local scale and under high aerosol (dust/sand/pollution) conditions.

Keywords: 3D-Var, Data Assimilation, Doppler Winds, Errors, NWP, Nonlinearity, Sensitivity

MODELLING EARTHQUAKE MAGNITUDE DATA USING TIME SERIES MODELS: A COMPARISON

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General area of research: Mathematical Modeling in Environmental Sciences

Abstract:

The present work aims at modelling and forecasting the magnitude of Fukushima, Japan earthquake occurrence data from January 1, 2009 to 31 July 2014 data. We use comprehensive and methodologically rigorous analysis for modelling and prediction. Model based on the theory of the stochastic point processes were used to approximate the earthquake occurrence pattern and evaluate its forecasting performance. The uses a Box-Cox transformation followed by Seasonal and Trend decomposition using Loess (STL) decomposition to separate the time series into trend, seasonal part, and residual. Also, different modelling techniques are examined, namely the moving average, simple exponential smoothing, Holt's exponential smoothing, Winners exponential smoothing, simple regression, multiple regression, time series decomposition and seasonal ARIMA model. Monthly data used to model the earthquake occurrences using the above-mentioned models. The assessment criteria based on the minimum model adequacy were established using different criteria specifically minimum ME, RMSE, MAE, MPE, MAPE, MASE and maximum coefficient of determination. The results obtained by the Seasonal ARIMA found to be the best among other models.

Keywords: Statistical seismology, exponential smoothing, STL decomposition, modelling, forecasting, earthquake, Seasonal ARIMA

BACKWARD BIFURCATION FOR SIR EPEDEMIC MODEL WITH CORONA-VIRUS INFECTION

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General area of research: Mathematical Modeling in Environmental Sciences

Abstract:

In SIR epidemic model, the infection-free steady state is globally table for $\mathcal{R}_0 < 1$ (the basic reproduction number, or threshold bifurcation parameter used to study the stability f the steady states) and unstable for $\mathcal{R}_0 > 1$. We have a forward bifurcation when $\mathcal{R}_0 = 1$ and a backward bifurcation may occur. When $\mathcal{R}_0 > 1$, an asymptotically stable endemic steady state exists. We investigate the biologically reasonable conditions for the change of stability. Numerical simulations with coronavirus infection is considered to show the usefulness and effectiveness of the theoretical results.

Keywords: Bifurcation; Coronavirus; SIR epidemic model; Stability; Steady states

Acknowledgment: *This work is generously supported by UAE University.*

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STUDY OF ACCIDENTS SCENARIOS RELATED TO CHEMICAL PROCESS

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General area of research: (Mathematical modeling in environrnental sciences)

Abstract:

Chemical industries process often have large inventory of hazardous chemicals, and process area is often highly congested with the presence of complex piping and various other equipment necessary for process operations, such as high pressure compression, separation, storage, and blending. These operating conditions can lead to industrial accidents that threaten human life, the environment the facilities and the equipments. It is well-known that among all accidental process-related events, fires and explosions are the most frequently reported loss-producing events. To prevent any such unwanted situation, industries have adopted different methods of hazard identification and accident prevention. Quantitative risk assessment and management is one of the most popular methods. Accident scenario analysis techniques are essential not only in learning lessons from unfortunate events.

In this paper we propose an approach for analyzing the scenarios of an accident related to a chemical process. The approach used in this paper is based on following steeps: Risk analysis, identification of top event, development of the top event. We consider the case of a chemical reactor for the application of this approach.

Keywords: Thermal runaway, HAZOP method, FMEA method, chemical process, chemical reactor.

PERFORMANCE ASSESSMENT OF EUROPEAN FOOTBALL TEAMS: USING INPUT ORIENTED STOCHASTIC DATA ENVELOPMENT ANALYSIS MODEL

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General area of research: Mathematical Modeling in Environmental Sciences **or** Other Areas of Mathematics.

Abstract:

Data Envelopment Analysis (DEA) is a powerful mathematical optimization method widely used for measuring, evaluating and improving the performance of Decision Making Units (DMUs). These used in the various forms, such as hospitals, government agencies, educational institutions, air force, bank branches, business firms, sport teams and even people including the performance of countries, regions, etc. Recently DEA has been extended to examine the performance through the different sport types. In this paper, a Stochastic Input Oriented Data Envelopment Analysis (SIODEA) Model is conducted for measuring and evaluating the relative efficiency scores of football teams selected from different European countries during 2014/2015 season each with some of inputs are stochastic with normally distributed and recent inputs are deterministic and outputs, to shed light on the professional football teams performance.

Keywords: Data Envelopment Analysis; Stochastic Variables; Efficiency Measurement; Football Efficiency; Performance Assessment

STATISTICAL MODELING AND FORECASTING THE NUMBER OF STUDENTS IN GENERAL EDUCATION PROGRAM

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General area of research: Mathematical Modeling

Abstract:

In this research a quantitative forecasting model has been created for studying the dynamics of the student population. Admission, curriculum, pre registration, registration, grading and record management are all supported by the mathematical model in one or the other way. This model explores the projection of the number of students enrolled in General Education (GE). A statistical modeling method is adapted in developing the model. As a case study we have used the data available on the website. The model predicts that the number of students in GE has the tendency to increase linearly with the slope of 71.227 and 114.95 for Dubai and Abu Dhabi campuses respectively and the limits for 95% confidence interval are (44.01, 98.44) and (87.42, 142.48). In assessing the fit of the model the significance of relationship calculated p value is less than 0.0003 in both Dubai and Abu Dhabi data sets.

Keywords: Student population, enrollment forecasting, linear model, standard error, confidence interval, posterior probability.

TESTS TO REDUCE TOXICITY OF LEAD BY INTERACTION SELECTIVE: LEAD/ZINC AND LEAD/COPPER; IN VITRO TESTS USING PHASEOLUS-VULGARIS PLANT.

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General area of research: Mathematical Modeling in Environmental Sciences

Abstract:

One of the crucial problems in matters of pollution is the accumulation of heavy metals and specifically lead throughout the food chain, and transfers to the man.
And as this element to the ability to cross all barriers and reaching the human body and cause a serious chronic poisoning such as lead poisoning on the nervous system.
It is in this context that our study is to reduce the toxicity of the element by applying the selective interaction mechanism Lead / Zinc and Lead / Copper to seek to optimize the antagonistic effect with an Application In -Vitro on the phaseolus vulgaris plant.

Keywords: Lead, Zinc, Copper, Phaseolus-vulgaris.

GEOMETRIC INTEGRATION WITH APPLICATIONS TO HAMILTONIAN SYSTEMS

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General area of research: Numerical Analysis

Abstract:

Geometric numerical integration is a relatively new area of numerical analysis. The aim is to preserve the geometric properties of the flow of a differential equation such as symplecticity or reversibility. A conventional numerical integrator approximates the flow of the continuous-time equations using only the information about the vector field, ignoring the physical laws and the properties of the original trajectory. In this way, small inaccuracies accumulated over long periods of time will significantly diminish the operational lifespan of such discrete solutions. Geometric integrators, on the other hand, are built in a way that preserve the structure of continuous dynamics, so maintaining the qualitative behavior of the exact flow even for long-time integration. The aim of this talk is to design efficient geometric integrators for Hamiltonian systems and to illustrate their effectiveness. These methods are implicit for general (non-separable) Hamiltonian systems making them difficult to implement. However, we show that explicit integrators are possible in some cases.
Both geometric and non-geometric integration methods are applied to several problems, then we do a comparison between these methods, in order to determine which of those quantities are preserved better by these methods.

Keywords: Hamiltonian systems, geometric integrators, dynamical systems, Hill's problem.

Bernstein polynomials Method for Numerical Solutions of Integro-Differential Form of the Singular Emden-Fowler Initial Value Problems

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Abstract

We are interested with the following singular nonlinear ordinary differential equations

$$y'' + \frac{k}{x}y' + \alpha h(x)\, g(y) = 0, \quad k \succeq 0, \quad 0 < x \preceq 1, \quad \alpha \succeq 0 \qquad (1)$$

with initial conditions $y(0) = a, \quad y'(0) = 0$

where h and g are some given functions of x and y respectively. Equation (1) is known as the Emden-Fowler equations and can modelize several phenomena in mathematical physics and astrophysics such as nuclear physics, theory of thermionic currents, the thermal behavior of a spherical cloud of gas and isothermal gas sphere. It occurs also in study of chemically reacting systems. The solution of Emden-Fowler equations has several known methods. A general study has been given in the works of Wazwaz by constructing both exact and series solutions to Emden-Fowler equations through Adomian decomposition method. Also, Yousefi presented this study by Legendre scaling functions. In the present article, we are concerned with the application of Bernstein polynomials (BPs) to the numerical solution of (1). The method consists of convert of Emden-fowler equations to integro-differential equations and expanding the solution by BPs with unknown coeffcients. The properties of BPs together with the Gaussian integration formula are then utilized to evaluate the unknown coeffcients and an approximate solution to equation (1). The main work is to establish the Volterra integro-differential form equivalent to the singular Emden-Fowler initial value problems. The newly obtained form facilitates the computational work and overcomes the difficulty of the singular behavior at $x = 0$. Using this procedure, the integro-differential forms have been reduced to solve a system of algebraic equations. Illustrative examples have been included to demonstrate the validity and applicability of the present technique. These examples also exhibit the accuracy and efficiency of the present method.

A CUTTING POINT TECHNIQUE FOR SECOND ORDER SINGULARLY PERTURBED DELAY DIFFERENTIAL EQUATIONS

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General area of research: Numerical Analysis

Abstract:

In this paper, we present a cutting point technique for solving singularly perturbed boundary value problem for the second order delay differential equation. Similar boundary value problems are associated with expected first-exit times of the membrane potential in models of neurons. The method is distinguished by the following fact: the original singularly perturbed two-point boundary value problem is divided into two problems, namely inner and outer region problems. The boundary condition at the cutting point is obtained from the solution of the reduced problem. Using general stretching transformation, a modified inner region problem is constructed. The modified inner region problem is solved as two-point boundary value problem. The solution of the reduced problem is considered as the solution of outer region problem. We combine the solutions of both the problems to obtain an approximate solution to the original problem. The proposed method is iterative on the cutting point. The process is to be repeated for various choices of the cutting point, until the solution profiles stabilize. Some numerical examples have been solved to demonstrate the applicability of the method. A lower bound for the cutting point of the boundary layer region is obtained in terms of the perturbation parameter and delay parameter.

Keywords: singularly-perturbed delay difference equation, inner region, outer region, cutting point.

A NEW METHOD FOR SOLVING OF TELEGRAPH EQUATION WITH HAAR WAVELET

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General area of research Numerical Analysis

Abstract:

In this paper we have introduced a computational method for a class of Telegraph Equation change to two-dimensional nonlinear Volterra integral equations, based on the expansion of the solution as a series of Haar functions. Also, by using the Banach fixed point theorem, we get an upper bound for the error of our method. Since our examples in this article are selected from different references, so the numerical results obtained here can be compared with other numerical methods. The telegraph equation is $u_{tt} + (\alpha + \beta)u_t + \alpha\beta\, u = c^2 u_{xx}$. Where $c^2 = \frac{1}{LC}, \alpha = \frac{G}{C}, \beta = \frac{R}{L}$ which consists of a resistor of resistance Rdx, a coil of inductance, Ldx, a resistor of conductance Gdx or a capacitor of capacitance Cdx.we have show that the telegraph equation can be reduced to an equation of the form

$$u(t,s) = f(t,s) + \int_0^s \int_0^t W_1(t,s,x,y,u(x,y))\, dxdy + \alpha \int_0^s W_2(t,s,y,u(t,y))dy + \beta \int_0^t W_3\ (t,s,x,u(x,s))dx, \quad (1)$$

The Banach fixed point theorem guarantees that under certain assumptions [1], the operation of equation (1) has an unique fixed point; that is, the two-dimensional Volterra integral equation has exactly one solution. The numerical solution of equation (1) is computed by using Rationalized Haar functions. Thus for the nonlinear two-dimensional Volterra integral equations by using Rationalized Haar functions

$$u_i(t,s) = f(t,s) + \int_0^s \int_0^t Q_m(\psi_1^{i-1}(t,s,x,y))\, dxdy + \alpha \int_0^s Q_m\left(\psi_2^{i-1}(t,s,y)\right) dy + \beta \int_0^t Q_m\left(\psi_3^{i-1}(t,s,x)\right) dx, \quad i = 1,2,\ldots$$

That Q_m an orthogonal projection with following interpolation property we have

$$Q_m(\psi_1^{i-1}(t,s,x,y)) = \sum_{\{i=0\}}^{\{m-1\}} \sum_{\{j=0\}}^{\{m-1\}} \sum_{\{r=0\}}^{\{m-1\}} \sum_{\{q=0\}}^{\{m-1\}} k^1_{\{ijrq\}} h_{ij}(t,s) h_{rq}(x,y)\,,$$

Thus K_1, K_2, K_3 are block matrices. In section of error analysis by using the Banach fixed point theorem, we get an upper bound for the error of our method.

Lemma. Let $W_1 \in C([0,1]^4 \times R^2)$, and $W_2, W_3 \in C([0,1]^3 \times \backslash R^2)$ are Lipschitz functions with respect to their fifth and fourth variables, with Lipchitz constants M_1, M_2 and M_3, then T has an unique fixed point and for all $u_0 \in C([0,1]^2$

$$\left|\left|u - T^i(u_0)\right|\right|_\infty \leq \left|\left|T(u_0) - u_0\right|\right|_\infty \times \sum_{\{j=i\}}^{\infty} q^j \ ,$$

where $q = M_1 + |\alpha| M_2 + M_3|\beta| < 1$, and u is the fixed point of T.

We illustrate the behavior of our numerical method by three examples.

Keywords: Two-dimensional integral equations; Rationalized Haar wavelet; Operational matrix; Fixed point theorem.

AN EFFICIENT MESHLESS METHOD FOR SOLVING OF PARABOLIC PDES WITH NONLOCAL BOUNDARY CONDITIONS

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Abstract

In this paper we apply an efficient approaches based on Bernstein polynomials to solve one-dimensional partial differential equations (PDEs) subject to the given nonlocal conditions. The main idea is based on collocation and transforming the considered PDEs into their associated algebraic equations. Numerical results are presented through the illustrative graphs which demonstrate
good accuracy.

NUMERICAL SOLUTION OF THREE COUPLED NONLINEAR SCHRODINGER EQUATIONS

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General area of research: Numerical Analysis

Abstract:

In this work we are going to derive a highly accurate generalized scheme for solving three coupled nonlinear Schrodinger equations. The scheme will be analyzed for accuracy and stability. The proposed scheme will be produced a block nonlinear tridiagonal system. Fixed point method is used to solve this system. The exact single soliton solution and the conserved quantity are used to assess the efficiency and the robustness of the scheme.

Keywords: Three Coupled nonlinear Schrodinger equations, block tridiagonal system, Soliton.

NUMERICAL SOLUTION OF KAWAHARA EQUATIONS BY USING LAPLACE HOMOTOPE PERTURBATIONS METHOD

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General area of research: Numerical Analysis

Abstract:
In this paper, we applied Laplace Homotope Perturbations Method (LHPM) to solve the Kawahara type equations. The numerical results obtained by (LHPM) are compared with exact solutions, homotopy analysis method (HAM), homotopy perturbation method (HPM), optimal Homotopy Perturbation method (OHPM) and Homotpy Perturbation and Variational Iteration method (VHPM) so that the results reveal the effectiveness of the suggested method and high accuracy.

Keywords: Kawahara equation, Modified Kawahara equation, Laplace Transform, Homotope Perturbations Method.

NUMERICAL SIMULATION of SOLIDIFICATION of STEEL in CONTINUOUS CASTING

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General area of research: Numerical Analysis

Abstract:

The present study deals with the numerical simulation of the solidification of steel in continuous casting. We consider a semi-discretization with respect to the time of the studied evolution problem; then we have to solve a sequence of stationary coupled problems. So, due to the fact that the temperature is positive, after reformulation of the problem into a variational inequality, we study under appropriate assumptions the existence and uniqueness of the solution of the stationary coupled problems. We also consider a multivalued formulation of the same problem which allows to analyze the behavior of the iterative relaxation algorithm used for the solution of the discretized problems. Finally the numerical experiments are presented.

Keywords: continuous casting, solidification of steel, sparse nonlinear systems, relaxation method.

FITTED NUMERICAL METHODS VIA SPLINES FOR SINGULARLY PERTURBED DIFFERENTIAL-DIFFERENTIAL EQUATIONS WITH SMALL SHIFT: LAYER AND OSCILLATORY BEHAVIOR

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General area of research: Numerical Analysis.

Abstract:

In this paper, we present numerical methods for singularly perturbed linear second order differential-difference equations of convection–diffusion type with a small shift, i.e., where the second order derivative is multiplied by a small parameter and the shift depends on the small parameter. Similar boundary value problems are associated with expected first-exit times of the membrane potential in models of neurons. When the shift parameter is smaller to the perturbation parameter, the Taylor series expansion of the shift term is facilitated and numerical methods via cubic spline in compression, cubic spline in tension with exponential fitting are developed. The methods are analyzed for convergence and shown to converge uniformly with respect to the perturbation parameter. When the shift parameter is larger than perturbation parameter a special type of mesh is used, so that the term containing shift lies on nodal points after discretization and the numerical methods via cubic spline in compression, cubic spline in tension are developed. The methods are compared with those in literature and the present results are found to be in good agreement, in terms of the order and convergence. An extensive amount of computational work, in the form of tables and graphs, has been carried out to demonstrate the proposed methods and to show the effect of shift parameter on the boundary layer behavior and oscillatory behavior of the solution of the problem.

Keywords: Singular perturbations, cubic spline in compression, cubic spline in tension, differential-differential equation.

NUMERICAL SOLUTION OF NONLINEAR FREDHOLM INTEGRO-DIFFERENTIAL EQUATION OF FRACTIONAL ORDER BY OPTIMAL HOMOTOPY ASYMPTOTIC METHOD

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General area of research: Numerical Analysis

Abstract:

Optimal Homotopy Asymptotic Method (OHAM) has been applied for solving a class of nonlinear Fredholm integro-differential equation of fractional order. In OHAM the convergence region can be easily adjusted and controlled. OHAM is also parameter free and provides better accuracy over other approximate analytical methods at the same order of approximation. Three examples with known exact solutions have been study for error analysis. The numerical results show that the OHAM is effective and accurate in finding the approximate solution of nonlinear Fredholm integro-differential equation.

Keywords: Optimal Homotopy Asymptotic Method, Fredholm integro-differential equation.

AN INVERSE PROBLEM FOR DELAY DIFFERENTIAL EQUATIONS: PARAMETER ESTIMATION AND SENSITIVITY ANALYSIS

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General area of research:- Numerical Analysis

Abstract:

This contribution presents a theoretical framework to solve inverse problems for Delay Differential Equations (DDEs). Given a parametrized DDE and experimental data, we estimate the parameters appear in the model, using Least Squares approach. We also investigate the sensitivity and robustness of the models to small perturbations in the parameters, using Variational approach. The results may provide guidance for the modelers to determine the most informative data for a specific parameter, and select the best fit model. The nonlinearity may make the problem ill-posed. Discontinuity and noisy data are also challenges.

Keywords: DDEs, Least Squares Approach; Identifiability; Nonlinearity; Parameter Estimation; Sensitivity;

RELIABILITY GROWTH MODELS FOR SOFTWARE SYSTEMS WITH IMPERFECT DEBUGGING PROCESS

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General area of research: Applied Mathematics/Operations Research

Abstract:

With the advancement in computer technology, software reliability is a primary concern for both software developers as well as users. In order to assure quality, the software reliability growth models (SRGMs) play a vital role throughout the software testing and operations phases. The assessment of software reliability by constructing the differential equation for the mean value function of the fault contents in the software can be done to evaluate the total system testing costs including warranty cost and is helpful for determining the optimal release time of the software. The reliability modelling of the software systems based on the non homogeneous Poisson process (NHPP) is presented. The key concepts for formulating the software reliability models with imperfect debugging and change point have been taken into consideration. The testing effort function (TEF) and fault reduction factor (FRF) are also included to solve the optimization problem associated with reliability constraint in the context of software testing. The numerical simulation and sensitivity analysis are performed to suggest the optimal release policies based on cost and reliability.

Keywords: Software reliability, Imperfect debugging, Change points, Optimal release policies.

CLASSIFICATION OF MICROARRAY DATA USING FLY ALGORITHM

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- **General area of research**: Applied Mathematics & Biomathematics

Abstract:

The process of microarray analysis can be defined as the set of methods and tools to quantitatively describe the contents of a data. It is generally divided into several stages: acquisition, scanning, preprocessing, segmentation, classification and interpretation. Consideration of all these phases clearly impacts on the quality of processing tasks and the execution time. In this paper, we look at the problem of classification of microarray data using fly algorithm.

Keywords: Microarray data, classification, fly algorithm.

DIFFUSION APPROXIMATION FOR $G^X/G^Y/r$ MACHINING SYSTEM WITH THRESHOLD POLICY FOR MULTI-REPAIRMEN

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General area of research:--Applied Mathematics/Operations Research

Abstract:

Machine repair problems have emerged as one of the leading areas of research due to their wide applicability in the fields related to manufacturing/production systems, communication and computer systems and many other industries. The diffusion approximation technique for a $G^X/G^Y/r$ repairable redundant system with multi-component machines and repair facility is suggested. The components of the machine repair system may fail/repair in group. The realistic concepts of system's failure due to common cause and customer's balking behavior have also been taken into account. The traffic intensity tending to unity leads to heavy traffic situation, so as to ensure the efficiency of the machining system. The multi-repairmen is made available for the repair jobs of failed machines according to a threshold policy. The diffusion process has been studied by constructing equations in terms of drift and variances of life time, repair time and batch size distributions. By using the elementary return boundaries (ERBs), the expressions for the queue size distribution are established in the form of probability density function which is further used to derive some performance measures have been derived in terms of drift and variances of diffusion process. Numerical results have been presented to authenticate the feasibility of analytical results for the computation purpose.

Keywords: Diffusion approximation, Threshold policy, Redundant system, Mixed spares,

THERMAL SHOCK PROBLEM OF TWO-TEMPERATURE GENERALIZED THERMOELASTICITY WITHOUT ENERGY DISSIPATION WITH ROTATION

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Abstract:
In this paper, we constructed a mathematical model forathermoelastichalf-space medium based on two-temperature generalized thermoelasticity without energy dissipation. The Laplace transforms techniques have been used to get the general solution for a particular model when the medium is subjected tothermal shock by using stat-space approach. The inversion of the Laplace transforms has been calculated numerically and after that we presented the results graphically with some comparisons to study the impact of thermal or mechanical load on the speed of progress of mechanical and thermal waves through the medium. Also, to studying the effect of the two-temperature parameter rotation parameter on all the studied field.

Keywords: Rotation; Two-Temperature Generalized Thermoelasticity; without Energy Dissipation; State-space approach

FRACTIONAL ORDER GENERALIZED THERMO- VISCOELASTICITY HALF- SPACE SUBJECTED TO RAMP TYPE HEATING

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Abstract:

This paper deals with the problem of thermo viscoelastic interaction in an initially stressed isotropic homogeneous half space, the governing equations will be taken in the context of the fractional order theory of generalized thermo- viscoelasticity based on the Lord and Shulman (L-S) theory. State space formulation with Laplace transform technique is used to obtain the general solution and the resulting formulation is applied to the ramp type increase in thermal load and zero stress. Solution of the problem in the physical domain are obtained by using a numerical method of MATLAP Programme and the expression for the displacement, temperature, strain and stress inside the half space are obtained. Numerical computations are carried out for a particular material for illustrating the results. Some comparisons have been shown in figures to estimate the effect of the fractional order parameter, ramp parameter, time on all studied fields

Key words: Generalized thermoelsticity; Viscoelastic; Fractional order; Lord and Shulman theory; State space approach; Ramp type heating.

A SIMPLIFIED APPROACH TO FIND THE SOLUTION FOR THE INTUITIONISTIC FUZZY TRANSPORTATION PROBLEM

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Abstract:

Roselin and Amirtharaj (Roseline Sagaya, Amirtharaj Henry, "New approaches to find the solution for the intuitionistic fuzzy transportation problem with ranking of intuitionistic fuzzy numbers", International Journal of Innovative Research in Science, Engineering and Technology vol.4, 10222-10230, 2015) proposed intuitionistic fuzzy Vogel's approximation method to find the initial intuitionistic fuzzy basic feasible solution of transportation problem as well as intuitionistic fuzzy modified distribution method to find the intuitionistic fuzzy optimal solution of fuzzy transportation problems. In this paper an alternative approach which is much easy as compared to the approach, proposed by Roselin and Amirtharaj, is proposed for the same. To illustrate the proposed approach of intuitionistic fuzzy transportation problem, considered by Roselin and Amirtharaj, is solved by proposed approach.

GRAPHICAL REPRESENTATION OF TRIANGULAR AND TRAPEZOIDAL COMPLEX FUZZY NUMBERS

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Abstract:

In last few years, a lot of researchers have proposed different methods for solving decision making problems in fuzzy environment by comparing the fuzzy numbers on the basis of their membership functions. Since, till now no one has defined the membership function of triangular and trapezoidal complex fuzzy numbers and hence, there is no method in the literature for comparing triangular and trapezoidal complex fuzzy numbers. Therefore, no one has used triangular/ trapezoidal complex fuzzy numbers in decision making problems. Keeping the same in mind, in this paper, the membership functions of triangular and trapezoidal complex fuzzy numbers as well as their graphical representations are proposed.

MODELING THE QUANTITATIVE PRECIPITATION OF HEAVY METALS BY JAVA SCRIPT LANGUAGE USING HARTINGER AND BRAUN DATA

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Abstract:

Excessive exploitation of water resources in industrial activities, generating a negative impact on ecosystem by wastewater discharges without prior treatment in the outfall, which can lead to contamination of the food chain by the mechanisms of kinetics.
It is in this vein that our research is the concept of modeling to eliminate transfers of pollutants by the quantitative precipitation of heavy metals by the pH control.
The exploitation of JAVA SCRIPT language allowed us to achieve very conclusive results.
The originality of this research is its compatibility with smarts-phones, for in-situ use.

Keywords: Modeling, heavy metals, pH, precipitation, JAVA-SCRIPT language.

NATURAL CONVECTION FLOW NEAR A VERTICAL PLATE WITH SUCTION/INJECTION AND OSCILLATORY BOUNDARY CONDITIONS

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Abstract:

This study present the effect of suction and injection on natural convection flow near a vertical plate with oscillatory boundary conditions. The flow in the channel is described by momentum and energy equation. Analytical expression for temperature, velocity, skin friction and rate of heat transfer for the steady state case is obtained using perturbation methods. A selected set of graphical results illustrating the effects various parametric values involved in the problem in the temperature and velocity profiles as well as skin friction and Nusselt number are presented and discussed.

Keywords: natural convection; vertical plate; suction/injection; oscillatory boundary condition.

MODELING AND NUMERICAL SIMULATION OF ATMOSPHERIC DISPERSION OF POLLUTANT. APPLICATION SOFTWARE: ALOHA, PHAST

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Abstract:

The modelling of the effects of dangerous phenomena is for two objectives, to assess the safety distance required by the reglementation in the hazard study, also to get the technical choice, for example: the conception of network of captors, the number and position of the network to detect the leak to optimize the equation detection/ reaction.
In spite of the high of the technical development of the accidents effects assessment tools and its wide use in oil and gas industry in Algeria, such as study in drilling operation still a few according other oil and gas activities, for that we choose this theme to give at least an idea about the dangerous phenomena, its effects and the safety measures of drill operations.

Keywords: modeling, simulation, accident risk, atmospheric dispersion

A COMMENT ON "A BI-OBJECTIVE PROGRAMMING APPROACH TO SOLVE MATRIX GAMES WITH PAYOFFS OF ATANASSOV'S TRIANGULAR INTUITIONISTIC FUZZY NUMBERS"

Tina Verma

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Abstract:

Li et al. [D.F. Li, J. X. Nan, Z. P. Tang, K. J. Chen, X. D. Xiang and F. X. Hong, A bi-objective programming approach to solve matrix games with payoffs of Atanassov's triangular intuitionistic fuzzy numbers, Iranian Journal of Fuzzy Systems, 9 (2012), 93-110] proposed an approach for transforming an intuitionistic fuzzy linear programming problem into its equivalent crisp linear programming problem. In this note, with the help of numerical example, it is shown that the intuitionistic fuzzy linear programming problem transformed by using this approach is not always equivalent to obtained crisp linear programming problem.

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Suleman Alfalqi	Saudi Arabia
Benmanseur Ouarda	Algeria
Jeevanjot Kaur	India
Akriti Jindal	India

Tina Verma	India
Ibrahim A. I. Suleiman	Jordan
Hebatallah Jamil AlSakaji	UAE
Anwaer Huessen	UAE
Jianhua Gong	UAE
Naser Al-Qutaifi	Kuwait
Mohamed A. Hajji	UAE
kobra karimi	Iran
R. N. Okereke	Abia State
A. Bahadori mehr	Iran