Day 1 Monday July 16^{th} 2012

Session 1A
Time: 10:00-10:40 am
Plenary Talk
Chair: Mustafa Abu-Safa

Unconventional Science and Engineering of Gas Shale Does it Matter for Palestine?

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It is now generally agreed that natural gas from tight rock formation, known as shale gas, may play a critical role worldwide to meet rising energy needs. Yet, for shale gas to assume its full potential as a sustainable energy resource, some critical issues in exploration and exploitation need to be addressed which all relate to the unconventional nature of the rock formations: a nanosized porespace, inorganic-organic interfaces between kerogen and clays, carbonates or SiO2; a 5-10 times higher fracture resistance than normal rocks. I.e. in short a formidable task for applied physics and physical chemistry. Herein, we present results from a bottom-up approach for gas shale research which combines molecular simulations with novel nano-to-microscale experiments. The possibility of the presence of shale gas in the West Bank make these results and the chosen approach highly relevant for Palestinian Physicists and Engineering Scientists.

Session 1B
Time: 11:00 am - 12:30 pm
Mathematics
Chair: Edriss Titi

Inverse Problems, Signal Processing and Imaging: Un Menage a Trois

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Inverse Problems deal with determining for a given input-output system an input that produces an observed output, or of determining an input that produces a desired output (or comes as close to it as possible), often in the presence of noise. Most inverse problems are ill-posed.

Signal Analysis/Processing deals with digital representations of signals and their analog reconstructions from digital representations. Sampling expansions, filters, reproducing kernel spaces, various function spaces, and techniques of functional analysis, computational and harmonic analysis play pivotal roles in this area.

Image Analysis and Processing deal with image refinement and recovery, and related problems in imaging science, include the important field of medical imaging.

Moment problems deal with recovery of a function or signal from its moments, and the construction of efficient stable algorithms for determining or approximating the function. Again this is an ill-posed problem. Interrelated applications of inverse problems, signal analysis and moment problems arise, in particular, in image analysis and recovery and in many areas of science and technology.

Several decades ago the connections among these areas (inverse problems, signal processing, and image analysis) was rather tenuous. Researchers in one of these areas were often unfamiliar with the techniques and relevance of the other two areas. The situation has changed drastically in the last 20 years. The common thread among inverse problems, signal analysis, and imaging is a canonical problem: recovering an object (function, signal, picture) from partial or indirect information about the object.

In this expository talk, we will provide perspectives on some aspects of this interaction with emphasis on sampling expansions in various function spaces, ill-posed problems for operator and integral equations, and ill-posed problems in signal processing. We will show that function spaces. In particular, reproducing kernel spaces, translation and shift-invariant spaces play a pivotal role in this interaction.

Stochastic Collocation Methods for Uncertainty Quantification on Arbitrary Sparse Samples

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We have develop a fast method that can capture piecewise smooth functions in high dimensions with high order and low computational cost. This method can be used for both approximation and error estimation of stochastic simulations where the computations can either be guided or come from a legacy database.

Monotone Operator Theory and Applications to Hyperbolic PDE's

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In this talk, I will focus on the treatment of hyperbolic PDE's under the influence of *supercritical interior and boundary sources.* The local solvability of such problems is hopeless via standard fixed point theorems or Galerkin approximations, due to the lack of compactness. I will describe a general strategy that can handle the local solvability of most monotone problems by using nonlinear semi-groups (Kato's Theorem). However, nonlinear semi-groups can only accommodate a globally Lipschitz perturbation of a monotone problem. Thus, going from globally Lipschitz sources to the full generality of supercritical sources will require a great effort.

In addition, I will discuss some recent results on convex integrals on Sobolev spaces (generalization to old results by Brézis-1972) which are essential to this strategy.

Session 1C
Time: 11:00 am - 12:30 pm
Physics
Chair: Imad Barghouthi

Path Integral Approach to Faraday's Law of Induction

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We derive a general form of the induced electromotive force due to a time-varying magnetic field. It is shown that the integral form of Faraday's law of induction is more conveniently written in the covering space. Thus the differential form is shown to relate the induced electric field in the nth winding number to the (n+1)th time-derivative of the magnetic field.

Monte-Carlo Simulations of Dipolar Interactions in Random Nanogranular Magnetic Systems

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Dipolar interactions play an important role in determining the magnetic properties of nano-granular solid systems. These effects are complex many-body problems, especially when the particles are poly-dispersed, located randomly, and have their easy axes randomly oriented. The need to examine dipolar interactions effects in random systems in detail requires the use of numerical techniques such as Monte-Carlo simulations since analytical models involve significant approximations. Various attempts were made to introduce interaction effects on the behavior of nanogranular random systems. One of these approaches is the Allia model where a fictitious temperature is introduced to the Langevin response of the superparamagnetic system such that L(mH/kT) is replaced by the modified function L(mH/k(T+T*)).

Recently, dipolar interaction effects in nano-sized magnetic system have been examined. In these studies, the results indicate that the nature of the interaction effects cannot be inferred from changes in the mean magnetization of the system. In a randomly oriented system of nano-sized particles, the dipolar interaction fields along the x, y, and z directions are found to be normally distributed with a mean close to zero dipolar fields. Thus, the probability of finding positive and negative dipolar fields is almost the same. The simulations of magnetization curves have shown that the magnetization of the system is depressed with increasing particles concentration. This has often been taken as denoting predominantly demagnetizing interaction fields and to infer that the overall local interaction fields are negative. This reduction in magnetization ascribes to the non-linear response of the magnetization to the applied field, which weighs the negative interaction fields more strongly than the positive fields. According to this picture the dipolar interaction effects cannot be deduced from changes in the average magnetization of the system. In addition, the idea of describing dipolar interactions in terms of a mean field that could be added or subtracted from the applied field in random systems is not justified. Also due to the non-linear effect of magnetization, the temperature variation of the initial susceptibility predicts an apparent ordering temperature that varies with temperature. The predicted negative ordering temperature cannot be considered as indicative of anti-ferromagnetic order. Hence, the idea of using a fictitious temperature to represent interaction effects does not adequately describe the magnetization of interacting superparamagnetic systems.

Heat Generation in Solids and the Prediction of Thermal Conductivity in Thin Dielectric Films using Heat Conduction Models

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In this study, the multidimensionality and time dependence of heat transfer will be investigated via the differential equation of heat conduction in various coordinate systems. The conditions under which a heat transfer problem can be approximated and simplify it as being a steady state one-dimensional problem. Thermal conditions on surfaces will be identified, and they might be expressed mathematically as boundary and initial conditions. The one-dimensional heat conduction problems will be solved and the temperature distributions within a medium and the heat flux are obtained. The general solution will be used to analyze the one-dimensional heat conduction in solids that involve heat generation, and then the heat conduction in solids with temperature-dependent thermal conductivity will be evaluated.

Session 2A
Time: 01:40-02:20 pm
Plenary Talk
Chair: Ahmed Khamayseh

Unstructured Mesh Methods in Lagrangian Biomedical Fluid-Structure Interaction Problems

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We show progress towards a realistic fluid-structure interaction simulation of the mitral value using an evolving unstructured 3D tetrahedral mesh in the fluid domain coupled to an established commercial code (LS-DYNA) in the solid domain. As valve leaflets approach each other, the fluid domain changes radically and the moving unstructured mesh needs to maintain element quality, fluid boundary layer mesh density, and must change mesh topology at certain critical times during the simulation. We exhibit novel computational mesh dynamics algorithms that maintain mesh quality and we exhibit mesh topology change algorithms that preserve the solution fields being computed. Preservation of solution fields (components of velocity and hydrostatic pressure) during mesh topology change operations is accomplished by limiting the change in the L-infinity norm of the solution fields to an acceptable damage tolerance. Algorithms will be demonstrated on a 3D prototype heart valve.

Session 2B
Time: 02:20 pm - 03:40 pm
Mathematics
Chair: Bassam Manasrah

The Story of an Equation-The Balsius Equation

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The Blasius equation is the equation given by

$$f^{'''}(\eta) + f(\eta)f^{''}(\eta) = 0$$

subject to the boundary conditions: f(0)=γ, f' (0)=-λ, f' (∞)=1 . The parameters γ and λ represent the blowing or suction rate and the plate velocity respectively. The equation describes the idealized flow of a viscous fluid past an infinitesimally thick, semi-infinite flat plate. It was first derived by Blasuis in 1908 almost one hundred years ago. In this talk we will explain the various properties of the equation in addition to the different methods used to solve it. Some open problems related to the existence and uniqueness of the solution will be addressed.

On the Annihilator Graph of a Commutative Ring

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Let R be a commutative ring with non-zero identity, Z(R) be its set of zero-divisors, and if a in Z(R), then let ann(a) ={ d in R — da = 0}. The annihilator graph of R is the(undirected) graph AG(R) with vertices Z(R) = Z(R)\0 and two distinct vertices x and y are adjacent if and only if ann(xy) not equal ann(x) U ann(y). It follows that each edge (path) of the zero-divisor graph of is an edge (path) of AG(R). In this paper, we study the graph AG(R). For a commutative ring R, we show that AG(R) is connected with diameter at most two and with girth at most four provided that AG(R) has a cycle. Among other things, for a reduced commutative ring R, we show that the annihilator graph AG(R) is identical to the zero-divisor graph of R if and only if R has exactly two minimal prime ideals.

Some Computations on Projective Modules over the ring of Polynomials over Division Rings

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Let D be a division ring with center the field k , and let A = D [x 1,..., x n], B=[x1,...,x n] be the polynomial rings over commutative indeterminates x1,...,x n .Then B is the center of A.

First we compute K0 (A), the Grothendieck group of A . In the case of B we have K0 (B) = Z as a consequence of Quillen - Suslin's Theorem. Therefore every finitely generated projective B - module is free. In the case of A, we have the following result due to Stafford.[Projective Modules over Polynomial Extensions of Division Rings,1980]: Every finitely generated projective right A - module is either free or isomorphic to a non-free projective right ideal of A whenever the centre of A is infinite.

As a consequence, we compute the K0 (A), One can see that it is trivial. For that reason, we study the monoid V (A) of the isomorphism classes of finitely generated projective right A -modules, it has more information than the group 0 K (A). In some cases, we may find non-free projective right ideals in A and we can give their generators. In addition a classification of non-free stably free right A -modules up to isomorphism is given by a structure of square matrices.

Minimum Semi-definite Rank of Graphs

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The minimum semi-definite rank (msr) of a graph is defined to be the minimum rank among all Hermitian positive semi-definite matrices associated to the graph. A problem of interest is to find upper and lower bounds for msr of a graph using known graph parameters such as the independence number of the graph, and the minimum degree of the graph. In this talk, we give sufficient conditions for when msr of a bipartite graph is equal to its independence number. The delta conjecture gives an upper bound for msr of a graph in terms of its minimum degree. We present different classes of graphs for which the delta conjecture holds.

Session 2C
Time: 02:20 pm - 03:40 pm
Physics
Chair: Othman Zalloum

Two-State Operation in Quantum dot Lasers

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Relaxation oscillations are well known in laser physics as resulting from the field-matter interaction. For the class B lasers, the oscillations possess some resonant properties and are featured by so called relaxation oscillation frequency. Class B laser sensitivity to external modulations at the relaxation oscillation frequency is an important property which is used for many applications in optical communications, data storage, environmental monitoring etc. More resonant frequencies appear in the multimode regime of operation and result from the mode-to-mode coupling. These frequencies are known as antiphase relaxation oscillation frequencies as the perturbed lasing modes slowly oscillate back to the steady state with phase shifted or antiphase oscillations. In multimode regime, the main relaxation oscillation frequency is defined by the sum of the modal intensities, and the set of antiphase relaxation oscillation frequencies depends on the individual modal intensities.

Semiconductor lasers based on quantum dots may operate at different transitions known as the ground state (GS) and the excited state (ES). We consider the dual lasing regime when the modes operate simultaneously at the GS and ES. The electron-hole asymmetry rate equations model consists of the equations for the intensities of the laser field in the cavity, the number of carriers in the wetting layer per dot and the occupational probabilities of the GS and the ES. The model accounts for a phonon-assisted interaction between these states, limited by Pauli blocking factors. The model has three non trivial steady state solutions: single GS lasing; dual (GS+ES) lasing; single ES lasing. The transition between these steady states appears via the transcritical bifurcation.

We prove that the capture/escape processes between the GS and ES, sufficiently affect the relaxation oscillations. For sufficiently small laser cavities it results in the two relaxation oscillation frequencies. These frequencies have different damping rates and are defined by the individual intensities of the modes operating at GS and ES. This independence is new in laser physics as neither of the two frequencies can be defined as the main relaxation oscillation frequency. For the longer cavities, relaxation oscillation frequency remains single, but GS-ES interactions lead to its significant increase. This effect can be important for multiple technological applications with high speed modulated optical signal.

Thermoelectric Effects in Layered Organic Conductors in Strong Magnetic Field

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Layered organic metals exhibit many interesting electronic properties, and they share many features with the High Tc cuprate superconductors (HTS) - a quasi-two-dimensional band structure, superconductivity and insulating behavior, unconventional superconductivity, but they are much cleaner systems and it has been possible to measure many details of their electronic energy levels using accurate techniques. More ever the electronic properties are often simple. As a result, the layered organics can often provide a great information about basic phenomena like electronic band formation, unconventional superconductivity, field induced charge density waves (CDW), and variety of exotic phases which have been predicted and measured.

To understand the electron processes in low-dimensional conductors, one needs detailed information on the energy spectrum of conduction electrons. Electron phenomena in degenerate conductors placed in a strong magnetic field when the cyclotron frequency of electrons is much greater than their collision rate are very sensitive to the form of the energy spectrum of charge carriers. The investigations of galvanomagnetic phenomena in many layered conductors at low temperatures, in practically accessible magnetic fields, have allowed one to determine the topological structure of the Fermi surface (FS) and some details of the electron spectrum in layered structures. Similar information on charge carriers can be obtained by investigating the thermoelectric resistance in a strong magnetic field. The dependence of the kinetic coefficient that relates the thermal flux density to the temperature gradient on the magnitude and orientation of a strong magnetic field does not contain any new information on the spectrum compared with that obtainable from the measurement of electric resistance; however, the investigation of thermoelectric phenomena in a strong magnetic field allows one to obtain essentially new important information on charge carriers; in particular, it allows one to determine the velocity distribution of charge carriers on the Fermi surface.

The linear response of electron system of layered conductor to temperature gradient in strong magnetic field is investigated theoretically. It is shown that the Q2D character of the charge carriers dispersion law results in giant quantum oscillation of the thermopower. The beating oscillations of the interlayer thermopower as a function of both the magnetic field magnitude and an angle between the normal to the Q2D layer plane and the magnetic field are shown to occur when the cyclotron energy is comparable with the interlayer transfer integral. It is shown that the positions of the beats are shifted with respect of those in the interlayer magnetoresistance.

A considerable group of layered organic conductors have multisheeted Fermi surfaces, and therefore consist of various topological elements such as corrugated cylinders and planes slightly corrugated along normal to the layers. The presence of several groups of charge carriers is considered.

Network Theory Where Microelectronics Meet Mathematics

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The vast development of microelectronics in the recent years has driven the integration density to billions of transistors on a single chip. As devices are scaled down and die areas enlarged, the essential part of the total on-chip delay in processing units is determined by the time needed for a signal to travel from one chip to another and from one part to another part inside the chip. Hence, the interconnect delay becomes the bottleneck in modern VLSI/system-on-chip (SoC) designs. Repeaters are normally used to regenerate long/global/SoC interconnects. Regular insertion of repeaters on the interconnect wire avoids delay and wire length dependence. Both the interconnect as well as the inserted repeaters are modeled using RLC network theory. A regular n-segment RLC network, representing the interconnect with the inserted repeaters, is analyzed and solved as could be found easily in the literature. In this work, based on ABCD matrix, Math is utilized efficiently to analyze and solve the problem of n-segment RLCG network representing on-chip interconnect regenerated using n number of on-chip inserted repeaters. A theoretical mathematical delay model is devised based on this theory. This delay model could be used to optimize long/global/SoC interconnects in terms of propagation delay. Also, it could be used to provide VLSI/SoC designers with optimal design parameters, such as the type as well as the position and size of repeaters to be used for interconnect regeneration, faster than with conventional HSpice.

A Three-Dimensional Magnetic Force Solution Between Axially Polarized Permanent Magnet Cylinders for Different Magnetic Arrangement

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A three-dimensional field and force solution are presented for axially polarized permanent magnet cylinders. The solution method entails use of a scalar potential, and ultimately leads to the numerical integration of the free-space Greens function over two of its spatial variables. The field components are expressed in terms of finite sums of elementary functions and are easily programmable. The field components are developed for different magnet arrangements by taking into account the back iron. Also the method of images is used. Some of the calculated results are in good agreement with the experimental data. The magnetic drag force between two magnets can be computed using the basic relation for the force on a distribution of current in an external field. The derived force formulae can be obtained also for different magnet arrangements in vertical motion. The derived field and force formulae are readily programmed and ideal for performing straight forward studies of the field distribution and force calculation of magnets from rare earth materials such as NdFeB.

Session 3B
Time: 04:00 pm - 05:20 pm
Statistics
Chair: Nureddin Rabie

Fitting General Linear Model for Longitudinal Survey Data Under Unequal Probability of Selection

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Data collected by sample surveys, and in particular by longitudinal surveys, are used extensively to make inferences on assumed population models. Often, survey design features (clustering, stratification, unequal probability selection, etc.) are ignored and the longitudinal sample data are then analyzed using classical methods based on simple random sampling. This approach can, however, lead to erroneous inference because of sample selection bias implied by informative sampling. To overcome the difficulties associated with the use of classical inference procedures for cross sectional survey data, Pfeffermann, Krieger and Rinott (1998) proposed the use of the sample distribution induced by the assumed population models, under informative sampling, and developed expressions for its calculation. Similarly, Eideh and Nathan (2006) fitted time series models for longitudinal survey data under informative sampling.

In this paper we fit the general linear model for longitudinal survey data under unequal probability of selection, using different covariance structures: the exponential correlation model, the uniform correlation model; see Diggle, Liang and Zeger (1994), and the random effect model; see Skinner and Holmes (2003).

Informative Bayesian Inference for the Skew Normal Distribution

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The usual normality assumption is unrealistic a lot of context ranging from finance to medicine.

For this reason the construction of flexible parametric distributions which allows several degrees of skewness or kurtosis has received increasing attention in the last decades. An interesting proposal to construct such a rich class of probability distributions is given by the skew normal distributio (Azzalini, 1985).

Motivated by stochastic frontier analysis which is usually intrinsically skewed we introduce and discuss an informative prior for the shape parameter of the skew normal distribution, showing that it leads to a closed form full conditional posterior distribution, particularly useful in MCMC computation. A Gibbs sampling algorithm is discussed for the joint vector of the parameters, given an independent prior distribution for the location and scale parameters. Simulations studies are performed to asses the performance of the Gibbs sampler and for comparing the choice of the informative prior against a flat noninformative prior.

Fitting Age-Specific Fertility Rates by a Skew-Symmetric Probability Density Function

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Mixture probability density functions had recently been proposed to describe some fertility patterns characterized by a bi-modal shape. These mixture probability density functions appear to be adequate when the fertility pattern is actually bi-modal but less useful when the shape of age-specific fertility rates is unimodal. A further model is proposed based on skew-symmetric probability density functions. This model is both more parsimonious than mixture distributions and more flexible, showing a good fit with several shapes (bi-modal or unimodal) of fertility patterns.

Tests for Random Agreement in Cluster Analysis

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The adjusted Rand index is a measure of similarity or agreement between two clusterings for the same dataset. It is calculated based on counting pairs of pointsand comparing the agreement and the disagreement between the two clusterings or two classi cation rules. In this paper, the adjusted Rand index is suggested as atest statistic for testing the null hypothesis of random agreement.

Session 3C
Time: 04:00 pm - 05:20 pm
Physics
Chair: Ayman Sweiti

Fission Barriers from Actinides to Superheavies

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Calculations of the fission barriers with allowance of triaxial deformation have been performed for the first time within the covariant density functional theory. Pairing is treated within the BCS approximation using seniority zero forces adjusted to empirical values of the gap parameters. Different pairing schemes and their impact on inner fission barriers have been studied in detail. In the actinides region the covariant density functional theory is successful in reproducing the height of the fission barriers in actinides at a level of accuracy comparable with the best non-relativistic phenomenological macroscopic+microscopic approaches. Our analysis of the results of calculations shows that allowing triaxial deformation reduces the height of the inner barrier by 1-3 MeV, in actinides, and the fission path between the first and second axially deformed minima goes through the valley characterized by γ-deformation close to 10°.

However, in even-even superheavy nuclei with Z = 112 120, the softness of nuclei in the triaxial plane leads to several competing fission paths in the region of the inner fission barrier in some of these nuclei. The outer fission barriers are considerably affected by triaxiality and octupole deformation.

Prospects of Testing Modified Newtonian Dynamics with LISA Pathfinder

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A unique signature of alternative gravity theories, which recover the modified Newtonian dynamics paradigm in their nonrelativistic limits, is their peculiar behavior in the vicinity of the points where the net gravitational pull exactly cancels. In the Solar System, for instance, these are the saddle points of the gravitational potential near the planets. Typically, such points are embedded into low-acceleration bubbles where one expects significant deviations from Newton's laws. As has been pointed out recently, the Earth-Sun bubble may be visited by the LISA Pathfinder spacecraft in the near future, providing a new window toward directly testing these theories. Considering the expected sensitivity of the LISA Pathfinder probe, I will discuss the prospects of such tests together with the implications of a possible null result.

Integral Inversions in the D-dimensional Space

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In the D-dimensional space, we discuss the inversion problem between the average of a function over one or several variables and the original function. We also present a simple relationship between the moments of this function and those of its avarages. In this way we extend to D-dimensions a formula used by Glauber to connect the phase-shift function and the potential for elactic scattering in the eikonal approximation.

Determination of Quantum Mechanical Resonances by the Optimized Spectral Approach

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The Rayleigh-Ritz procedure for determining bound-states of the quantum-mechanical Schrödinger equation relies on spectral representation of the solution as a linear combination of the basis functions. Several ways of extending this approach to resonance states have been considered in the literature. Here we propose the application of the optimized Rayleigh-Ritz scheme which proved successful for bound-states. The method uses a basis of functions with adjustable nonlinear parameters, the values of which are fixed so as to make the trace of the variational matrix stationary. Generalization to resonances proceeds straightforwardly by allowing nonlinear parameters to be complex numbers. We study particles trapped in different one-dimensional and spherically symmetric potentials. Using the appropriately chosen basis sets, we demonstrate the that the optimized Rayleigh-Ritz scheme with complex parameters provides an effective algorithm for the determination of both the energy and lifetime of the resonant states. The method is computationally inexpensive since it does not require iterations or predetermined initial values. For the considered systems the convergence rate of our method compares favorably to those obtained in other approaches.

Day 2 Tuesday July 17^{th} 2012

Session 3A
Time: 08:50 am -09:30 am
Plenary Talk
Chair: Ibrahim Al-Masri

Application of Singularity Theory to Discrete Planar Dynamical Systems

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The main objective of this talk is to apply singularity theory due to Hassler Whitney to issues of global dynamics such as invariant manifolds, bifurcation, and global stability. We will focus on planar discrete dynamical systems generated by smooth maps. The notion of a general fold due to Whitney will be utilized and renamed as critical curves which were popularized by Mira, Gardini, and their collaborators. Points on the plane will be classified as regular, fold, a cusp, or none of the above. A planar map is called excellent if all the points in its domain are of the first three types mentioned above. We will put forward the following conjecture. For smooth excellent and proper planar maps, local stability implies global stability provided that the boundary of the domain is invariant. Our team proved the conjecture for many maps including those representing competition models in economics and population biology. The conjecture has far reaching application in dynamical systems and their application to science. We hope that this conjecture would draw as much attention as the celebrated Markus-Yamabe conjecture.

Session 4B
Time: 09:30 am - 11:00 am
Mathematics
Chair: Yousef Zahaykeh

Dynamics of K^{th} Order Rational Difference Equation

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In this talk we will investigate the dynamical behavior of the following rational difference equation

$$x_{n+1} = \frac{\alpha + \beta x_n + \gamma x_{n-k}}{A + Bx_n + Cx_{n-k}} \qquad n = 0, 1, ... \tag{1}$$

where the parameters α, β, γ and A, B, C and the initial conditions $x_{-k}, \ldots,$ x_{-1}, x_0 are non-negative real numbers, and the denominator is nonzero. Our concentration here, is on the global stability, the periodic character, the analysis of semi-cycles and the invariant intervals of the positive solution of the above equation. It is worth to mention that our difference equation is the general case of the rational equation which is studied by Kulenovic and Ladas in their monograph (Dynamics of Second Order Rational Difference Equation with Open Problems and Conjectures, 2002).

Bosonization for Dual Quasi-Bialgebras and Preantipodes

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Let H be a bialgebra. Consider the functor $T := (\hat{a}^{\cdot}) \otimes H : M \to (M^H)_H$ from the category of vector spaces to the category of right Hopf modules. It is well-known that T determines an equivalence if and only if H has an antipode, i.e., it is a Hopf algebra. The fact that T is an equivalence is the so-called fundamental (or structure) theorem for Hopf modules, which is due, in the finite- dimensional case, to Larson and Sweedler (see"An associative orthogonal bilinear form for Hopf algebras"). This result is crucial in characterizing the structure of bialgebras with a projection as Radford-Majid bosonizations (see "The structure of Hopf algebras with a projection"). This is a starting point ingredient in the so-called lifting method for the classification of finite dimensional pointed Hopf algebras, see "Lifting of quantum linear spaces and pointed Hopf algebras of order p^3". In this paper "Preantipodes for Dual Quasi-Bialgebras" we showed that, for a dual quasi-bialgebra H, a structure theorem holds if and only if there exists a suitable map $S : H \to H$ that we called a preantipode for H. Moreover for any dual quasi-bialgebra with antipode (i.e. a dual quasi-Hopf algebra) we constructed a specific preantipode.

The main aim of this talk is to introduce and investigate the notion of bosonization in the setting of dual quasi-bialgebras. Explicitly, we associate a dual quasi-bialgebra $R\#H$ (that we call bosonization of R by H) to every dual quasi-bialgebra H and bialgebra R in the category of Yetter-Drinfeld modules over H (YD). Then, using the fundamental theorem, we characterize as bosonizations the dual quasi-bialgebras with a projection onto a dual quasi-bialgebra with a preantipode. As an application, for any dual quasi-bialgebra A with the dual Chevalley property (i.e. such that the coradical of A is a dual quasi-subbialgebra of A), under the further hypothesis that the coradical H of A has a preantipode, we prove that there is a bialgebra R in YD such that grA is isomorphic to $R\#H$ as a dual quasi-bialgebra.

The Concept of q-Cycles and Some of its Applications

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Let F be the finite field of q elements and let N be a positive integer relatively prime to q. A sequence of distinct elements $a_0, a_1, \ldots, a_{\ell-1} \subseteq \{0, 1, \ldots, N-1\}$ is called a q-cycle mod N if $a_i q \equiv a_{i+1} \bmod N$, where the subscripts are taken mod ℓ. Arithmetic and algebraic properties of q-cycles are presented and its use in yielding simple proofs of several known results about order and degree of polynomials over a finite field is discussed.

Session 4C
Time: 09:30 am - 11:00 am
Physics
Chair: Adi Nusser

Density Functional Theory on a Lattice: Transport Through a Quantum dot

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In order to investigate the applicability of density functional theory (DFT) for transport phenomena, we have studied a model systems, namely a quantum dot of a few sites coupled to infinite 1-D leads. While the local-density approximation generally gives poor results, It was found that the "optimized effective potential" is quite reliable for weak interaction. For medium interaction, a combination of DFT with the exact diagonalization of small clusters is most promising. However, we also identify long-ranged contributions to the exchange-correlation potential which at present are not sufficiently explained, and require further investigations.

PIC Relativistic Code to Simulate Earth's Bow Shock

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Particles-In-Cell (PIC) Electromagnetic Relativistic code is used to simulate Earths bow shock (BS) under specified solar wind (SW) and north interplanetary magnetic field (IMF) conditions. Our simulations reproduce the theoretical jump conditions at the shock with specific density and temperature distributions. The obtained distribution is probably related to the multi-components nature of the velocity distribution upstream of the bow-shock. The BS position is found at a distance of 14.8 RE along the Sun-Earth line, and ∼29 RE on the dusk side, consistent with past in situ observations. The outcome of our simulations calls for coordinated efforts to apply PIC codes on existing and future observations of the large scales of the Earth's magnetosphere.

Fractional Calculus and their Applications in Physics

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Fractional calculus is one of the generalizations of the classical calculus. In recent years, considerable progress has been made in the area of fractional derivatives and its applications which include classical and quantum mechanics, field theory, and optimal control. However many problems are still open in this field and in the future, therefore future research is necessary in this direction.

In this talk we will give some physics applications to fractional calculus, with a hope that our method will predict new fundamental particles.

Session 5B
Time: 11:20 am - 12:40 pm
Mathematics
Chair: Abdulhakeem Eideh

HYPO4D: A Space-Time Parallelized Solver for Finding Unstable Periodic Orbits in Turbulent Flow

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Predicting the properties of turbulent fluids is a major challenge in terms of its theoretical and practical aspects. It is of great relevance in practical areas as diverse as weather forecasting, transport and dispersion of pollutants, gas flows in engines, blood circulation, cosmological flows among many others. The algorithmic complexity of the Navier-Stokes equations typically scales roughly as Re^3 , where Re is the Reynolds number.

In turbulent flow, the value of Re can easily reach values above 10^6 , a regime that can no longer be tackled using Direct Numerical Simulation (DNS). Within this project we follow an alternative approach. Here we identify the unstable periodic orbits (UPOs), from which we can extract the statistical properties of the Navier-Stokes equations in the turbulent regime. The importance of periodic orbits in dynamical systems has been recognized since the work of Poincare. The attracting set for a driven dissipative system can be thought of as the closure of the set of all the unstable periodic orbits (UPOs) of the system. These UPOs provide a countable sequence of orbits and can therefore provide a valuable characterization of the structure and dynamics of the attractor.

Recently, much progress has been made in this area. A number of UPOs have been found in plane Couette flow within a weakly-turbulent regime, of which the averages were in good agreement with the whole time sequence of the flow. More recently, other authors have extended this work to a more systematic computation of UPOs in Couette flow. In our previous TeraGrid project, supplemented by an early user allocation on the 1.0 PFLOP/s JUGENE BlueGene/P machine in Julich, Germany, we have found several UPOs by performing a four-dimensional analysis on a large number of snapshots from a lattice-Boltzmann simulation. In this analysis, we varied both the starting point and the length of the candidate period and used the conjugate gradient and gradient descent method to minimize the candidate orbits to UPOs.

In this talk we will present HYPO4D, a fluid simulation code that parallelizes not only space but also time. We will describe the concept of space-time parallelization, present results from large-scale computations using the Conjugate Gradient and Gradient Descent methods applied to a number of turbulence problems, and provide an overview of an enhanced version of the code which we are currently developing.

Modeling and Simulation of a Laser-Induced Cavitation Bubble with Phase Transition

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We present a numerical investigation for the collapse and rebound of a laser-induced cavitation bubble in liquid water. The compressibility of the liquid and vapor are involved. In addition, great focus is devoted to study the effects of phase transition and the existence of a non-condensable gas on the dynamics of the collapsing bubble. If the bubble contains vapor only we use the six-equation model for two-phase flows that was modified in our previous work [A. Zein, M. Hantke, and G. Warnecke, J. Comput. Phys., 229(8):2964-2998, 2010]. To study the effect of a non-condensable gas inside the bubble we add a third phase to the original model. In this case the phase transition is considered only at interfaces that separate the liquid and its vapor. The stiffened gas equations of state are used as closure relations. We use our own method to determine the parameters in them in order to obtain reasonable equations of state for a wide range of temperatures and make them suitable for the phase transition effects. We compare our results with experimental ones. Also our results confirm some expected physical phenomena.

New Results on the Collatz Conjecture

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In this talk we study the distribution of the last digits under iteration of the 3n+1 and Syracuse problems. We prove that the related distributions are uniform for the even numbers and for the odd numbers for the pre-images of a given initial condition. We formulate an equivalent conjecture to the Collatz related conjectures of the non-existence of cycles without the number 1.

A Monte-Carlo Simulation Study of a Folded Kernel-based Goodness-of-Fit Test

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Bickel and Rosenblatt [1973] proposed a nonparametric goodness-of-fit test, for testing Ho : f = fo, based on a weighted L2-distance between the kernel density estimate and the hypothesized density. Dabeet [1992] proposed a nonparametric goodness-of-fit test, for testing Ho : f = fo, based on a weighted L2-distance between the folded kernel density estimate and the hypothesized density.

A Monte-Carlo simulation method is used to evaluate the power of the Bickel-Rosenblatt test and the Dabeet test under three types of nonparametric alternatives. The Dabeet test is compared with the Bickel-Rosenblatt test as well as with several well-known tests based on the empirical distribution function including Kolmogorov-Smirnov test, Kuiper test, Watson test and the well-known Chi-square goodness-of-fit test . The preliminary findings of the study indicate that the Dabeet test has reasonable and higher power in several cases.

Session 5C
Time: 11:20 am - 12:40 pm
Physics
Chair: Sami Al-Jaber

Optical Measurements of Two-Layer System Considering Chromatic Correction

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A common method for measuring thickness of thin films is thin film reflectance (TFR). TFR captures the light intensity reflected by a film in form of a spectral signal. The resulting reflectance is a function of the film thickness, which can be extracted by fitting this signal with a valid model. In some applications, such as manufacturing of electronic components, different layers of coatings are applied successively on a substrate. The correct thickness of such layers is essential for guaranteeing the electronic behavior of the produced device and must be therefore controlled carefully. However, when TFR is used to test such a surface, the thickness of all layers affect the captured signal simultaneously and cannot be measured individually. In this case, transfer-matrix based or recursive models are commonly used to extract the thickness values.

This paper aims to present a model for measuring two layer systems through TFR. On one hand, this work extends the state-of-the-art by including the setup characteristics in the final model. On the other hand, it provides a model, which can be directly applied to practical measurements of two layer systems. The results describe not only the layer thickness, but also the chromatic effect introduced by the measurement setup. To ignore the chromatic distortions in the model can conduce to significant errors in the thickness measurements.

We validate the proposed model through a set of experiments conducted upon two groups of surfaces: two absorbing layers on silicon substrate and two absorbing layers on PET substrate. Although the presented experimental results concentrate on these two configurations, the model can be used for other kinds of materials with known optical parameters. Our experimental results show a high degree of agreement with those obtained by stylus measurement. This suggests that the proposed method can be successfully used in industrial applications requiring fast and non-contact inspection of two layer systems.

Soleil Emittance Reduction using a Robinson Wiggler

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For both synchrotron light sources as SOLEIL and colliders, the emittance is one of the key parameters to increase the photon brightness and the beam luminosity. In order to decrease the emittance, the ring optics is built on very focusing lattices leading to large chromaticities and potential reduction of the dynamics aperture and momentum transverse acceptance. Thus, some facilities have installed damping wigglers in zero dispersion straight sections to relax the optics and to reach sub-nanometer horizontal emittances. This solution requires however tens or hundreds meters of insertion devices. For storage ring equipped with zero-gradient bending magnets, an alternative solution can be given by installing a single Robinson wiggler in a dispersive section enabling to divide the emittance by a factor of 2. The uniqueness of this wiggler results from the presence of an alternated gradient superimposed the main periodic magnetic field. This paper recalls the concept of the wiggler, presents the expected gain for SOLEIL storage ring with the impact on the linear optics and the brightness. A preliminary magnetic design is also proposed.

Dual Fuel Performance and Engine Noise using Variable LPG Composition Fuel

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This work studies experimentally the effect of LPG fuel with different composition (Propane to Butane volume ratio of 100:0, 70:30, 55:45, 25:75, and 0:100) on the performance of dual fuel engine. A single cylinder, naturally aspirated, four strokes, indirect injected, water cooled modified Ricardo E6 engine, is used in this study. The study is carried out by measuring engine's operation conditions under different engine's parameters such as engine speed, ignition timing and compression ratio. The engine performance under variable LPG fuel composition is estimated by investigating: the cylinder indicated mean effective pressure, maximum rate of pressure rise, thermal efficiency and the heat release rate. The experimental data indicates that the engine parameters are playing a major role on the engine's performance. Different LPG fuel composition did not show a major effect on the engine efficiency but it directly impacted the levels of generated combustion noise.

Effect of Salt on Electric Double Layer of Spherical Macroion

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The structure of the electrical double layer (EDL) of a spherical macroion with a total charge of 60 elementary charges immersed in multivalent salt solutionin has been studied by Monte Carlo (MC) simulation. Throughout the calculation the primitive model has been implemented and the continuous model for the macroion charge has been used, in which the total charge was concentrated in the center of the macroion. In the primitive model the macroions and the small ions are represented by hard spheres and the water enters through its dielectric constant. The radial profiles of local densities and electrostatic potential in EDL, as well as the degree of counterion binding by the macroion, are calculated. It is established that the valence of counterion significantly affects the EDL structure near the macroion, whereas its effect is much weaker at larger distances. At high salt concentrations, the macroions become overcharged so that their apparent charge has the opposite sign to the stoichiometric one. As a result the zeta potential is inverted to a positive one. This inversion is remarkably large as the valence increases.

Session 4A
Time: 02:00 pm - 02:40 pm
Plenary Talk
Chair: Amjad Barham

Einstein for Everyone

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The basic message and framework of the Einsteinian relativistic world would be expounded by using the simple common sense general arguments which would be accessible to one and all. Besides there would be something very novel and interesting for experts as well in terms of a new perspective and an insightful use of general concept of universality.

Session 6B
Time: 02:40 pm - 04:00 pm
Mathematics
Chair: Peter Coveney

On the Oscillation of Bounded Solutions of Third-Order Nonlinear Delay Differential Equations

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The aim of this paper is to study the oscillatory behaviour of bounded solutions of the third order non-linear delay differential equation

$$(a(t)(x^{''}(t))^{'} + Q(t)f(x(\sigma(t))) = h(t)$$

Where a(t) is continuous, positive, differentiable function, $\sigma(t)$ is less than or equal to t. We establish a new conditions which guarantee that every bounded solution is oscillatory.

Latest Characterization of Periodic Solutions of Periodic Difference Equations

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It is well known that if a continuous function maps a closed interval into itself, then it has a fixed point. Fixed points of a map f and convergence of sequences obtained by iterating f at points in its domain have been widely investigated in many branches of mathematics. Fixed points of the iterates of f are called cycles, or periodic solutions of the difference equation $x_{n+1} = f(x_n)$. Fixed points (or steady states) as well as periodic solutions play a significant role in understanding the dynamics of difference equations.

In this talk, we consider the general difference equation $x_{n+1} = f(n \bmod p, x_n)$, which can be used to model certain populations in fluctuating environments. We associate a periodic solution of $x_{n+1} = f(n \bmod p, x_n)$ to a digraph, and use the diagraph to establish a relationship between the cycles of the difference equation. Characterizing periodic solutions of $x_{n+1} = f(n \bmod p, x_n)$ has been a hot topic of research in the past few years. However, some questions remain unanswered. Here, we give some recent results and some open questions about this problem. In conclusion, we find that when graph theory meets analysis, several challenging and lengthy results in analysis become relatively manageable.

An Approach to Obtain Asymptotic Expansions of Some Functional Iterates

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Analyzing a work of Bencherif-Robin in 1994, we present a systematic approach to derive an asymptotic expansion for the iterates $u_0, u_n = f(u_{n-1})(n \geq 1)$ of a continuous function $f(x)$. There are three main steps in the approach consisting of

Step 1: Transform (u_n) into a simples sequence (v_n) and construct a new function $\Psi(x)$, where inverse becomes the leading part of (v_n).

Step 2: Derive an asymptotic estimate for $\Psi^{-1}(n)$ via another sequence $(T_n(x))$ whose derivatives satisfy a binary recurrence relation.

Step 3: Simplify the result obtained in Step 2 through algebraic and analytic manipulation.

Dynamics of Human Decisions

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We study a dichotomous decision model, where individuals can make the decision yes or no and can influence the decisions of others. We characterize all decisions that form Nash equilibria. Taking into account the way individuals influence the decisions of others, we construct the decision tilings where the axes reflect the personal preferences of the individuals for making the decision yes or no. These tilings characterize geometrically all the pure and mixed Nash equilibria. We show, in these tilings, that Nash equilibria form degenerated hystereses with respect to the replicator dynamics, with the property that the pure Nash equilibria are asymptotically stable and the strict mixed equilibria are unstable. These hystereses can help to explain the sudden appearance of social, political and economic crises. We observe the existence of limit cycles for the replicator dynamics associated to situations where the individuals keep changing their decisions along time, but exhibiting a periodic repetition in their decisions. We introduce the notion of altruist and individualist leaders and study the way that the leader can affect the individuals to make the decision that the leader pretends.

Session 7B
Time: 02:40 pm - 04:00 pm
Mathematics- Gaza- via Skype
Chair: : Khawla Almuhtasib

Creating Effect Algebras

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In this paper we present a construction which produces an effect algebra $(E_a)_{a\in A}|L$ from a finite orthomodular poset L with atoms A and a family $(E_a)_{a\in A}$ of (disjoint) effect algebras, one for each atom of L. We show, further, that L can be embedded into $(E_a)_{a\in A}|L$ as a subeffect algebra. When each E_a is isomorphic to the real unit interval $[0,1]$, we obtain $([0,1]_a)_{a\in A}|L$, which we call the standard fuzzification of L.

On Nonstandard Topology

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Nonstandard topology is a kind of topology constructed by means of nonstandard analysis. In the literature, most books and research articles talk about nonstandard analysis. They rarely talk about nonstandard topology. Indeed, it is hard to find a single book or article that gives a comprehensive study of nonstandard topology. In this thesis, we did our utmost efforts to survey and collect most of the information that have been scattered in the literature and that deal with nonstandard topology. We present to the reader all what he wants to know about the subject in a simple and correlative way that mimics the presentation of standard topology by any elementary textbook. Thus this thesis can be considered as an introductory textbook on nonstandard topology that will be very helpful and useful for the researchers who will be interested in developing topology in the sense of the nonstandard methods.

On the Influential Points in Error-in-Variables Model for Directional Data

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This paper considers the problem of the influential points in studying the underlying relationship between two circular variables via the functional relationship model. The simple functional relationship model is given by:

$$Y_i = \alpha + \beta X_i (mod 2\pi), \quad for i = 1, 2, ..., n \tag{1}$$

where $x_i = X_i + \delta_i$ and $y_i = Y_i + \epsilon_i$

where δ_i and ϵ_i are independently distributed with von Mises distributions, that are $\delta_i \sim VM(0,\kappa)$ and $\epsilon_i \sim VM(0,\nu)$, with a constant ratio of error concentrations. The complex form of model (1) can be expressed in the following form:

$$(cosY + isinY) = \alpha + \beta(cosX_j + isinX_j) \tag{2}$$

where $(\cos x_j + i\sin x_j) = (\cos X_j + i\sin X_j) + \tau_j$

and $(\cos y_j + i\sin y_j) = (\cos Y_j + i\sin Y_j) + \eta_j$

where τ_j and η_j are independently distributed from the bivariate complex Gaussian distributions, with $\tau_j \sim CN(0,\Sigma_x)$ and $\eta_j \sim CN(0,\Sigma_y)$ with a constant ratio of error variances.

The covariance matrices are derived for both models and then the COVRATIO statistic is extended from the linear regression models to the functional relationship models. The cut-off points and the power of performance of the COVRATIO statistics are evaluated for both models via simulation. It is found that the COVRATIO statistic for the simple functional relationship model performs better than COVRATIO statistic of the complex form model.

For illustration purposes, the proposed procedures are applied on a real data consists of 129 measurements of wind directions measured by two different instruments. Both procedures were able to identify two observations as influential points.

Reliability of Connected (1,2) or (2,1)- out- of-(m,n): F Linear & Circular Lattice Systems using Markov Chains

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The connected (r,s) or (s,r)-out-of-(m,n): F lattice systems fails if and only if at least any connected subset of (r,s) or (s,r) of failed components occurs. For example the connected (1,2) or (2,1)-out-of-(m,n): F lattice systems fails if at least a (1,2)-matrix (i.e. a row with 2 components) or a (2,1)-matrix (a column with two components) of failed components occurs. Many researchers set numerous algorithms to compute the reliability of such systems.

In this paper, a new algorithm is given for evaluating the reliability of (1,2) or (2,1)-out-of-(m,n): F linear and circular lattice systems. This algorithm depends on representing the functioning states of the system as the states of a suitable Markov chain; this gives the possibility of computing the reliability in terms of the transition probabilities of the considered Markov chain. The new algorithm seems to be much simpler than the existing ones in the literature. Furthermore the computation process of the reliability of the circular system is simpler than the linear system since the number of states of the Markov chain in the circular case is smaller than that of the linear case.

Session 8B
Time: 04:15 pm - 05:30 pm
Mathematics
Chair: Mohammad Saleh

Norm Attaining Operators

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The Bishop-Phelps Theorem states that the set of a (bounded and linear) functional on a Banach space that attain their norm is dense in the dual space. In the complex case, Lomonosov proved that there may be a closed, convex and bounded subset C of a Banach space such that the set of functionals whose maximum modulus is attained on C is not dense in the dual. This paper contains a survey of versions for operators, multilinear forms, and polynomials of the Bishop-Phelps Theorem. Lindenstrauss provided examples of Banach spaces X, Y such that the set of norm attaining operator from X to Y is not dense. He also gave isometric conditions on X for which the set of norm attaining operators from X to Y are dense in the space of all operators between Banch spaces.

An Algebraic Approach to Fractional Derivatives

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A derivative of a function of order r , for any real number r (called a fractional derivative) is the subject of this talk. Here a new definition of the fractional derivative of order r of a function is given. This new definition will depend on the formal power series summation. We used this new definition to find the fractional derivative of the constant functions and the polynomials. The result was the same result by using the known definitions of fractional derivatives until now. Also, we proved properties of the fractional derivative. Also, we proved that the fractional derivative of order r of the exponential function is the exponential function and this will help us in finding the fractional derivatives of the trigonometric functions and hyperbolic functions.

The purpose of this research is to find an easy way to derive the fractional derivatives for the functions, since every differentiable function can be represented by power series expansion, even if the radius of convergence of the power series is 0, we believe that this method will give nice results which can be used in the application.

Variety of Some Finite Algebra

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In universal algebra, a variety of algebra is a class of all algebraic structures of a given signature satisfying a given set of identities. Equivalently a variety is a class of algebraic structures of the same signature which is closed under the taking of homomorphic images, subalgebras and direct products. The study of varieties was initiated by Garrett Birkhoff in 1935; he proved equivalent the two definitions of variety given above, result of fundamental importance to universal algebra and known as Birkhoff's theorem . One of the most fruitful directions of research was initiated by mal'cev in 1950's when he showed the connection between permutability of congruences for all algebras in variety V and the existence of aternary term p such that V satisfies certain identities involving p. In this work we study the varieties generated by finite elements groupoids. On aset of two elements a,b there are 16 different binary operations (groupoids),8of them are associative groupoids that have been investigated (like group , semilattice ,semigroup with zero multiplication),and there are 8 of them are non-associative groupoids. In this work we determine which of the varieties generated by two elements non-associative groupoids are atoms(minimum), and which of them generated by semigroup right zero or left zero.

Bad Boundary Behavior in the de Branges-Rovnyak Spaces

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We study the bad boundary behavior of functions in some complex function spaces inside Hardy space defined on the open unit disk. Recently Hartmann and Ross found estimators for functions in the de Branges-Rovnyak spaces when the function b is an inner function and Ahern-Clark condition fails to be satisfied. We present this result and generalize it for general function b in the unit ball of the space of analytic bounded functions on the open unit disk.

On Subclasses of Multivalent Functions Involving the Komatu Integral Operator

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This talk is devoted for the study of some new subclasses of strongly close-to-convex p-valent functions defined by a multiplier operator using the Komatu integral operators and the study their inclusion relationships with the integral preserving properties.

Session 6C
Time: 04:15 pm - 05:30 pm
Physics
Chair: Musa Abu-Teir

Square Waves in Semiconductor Ring Laser Subject to Optical Feedback

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We study experimentally and numerically a new dynamical regime in the operation of semiconductor ring lasers (SRLs) subject to long delayed optical feedback. When employing an asymmetric feedback scheme, we find experimentally that the SRL can show square-wave intensity oscillations with a 50% duty cycle. In this scheme, where the output in the one direction is delay coupled to the other direction but not vice versa, the laser switches regularly between the clockwise (CW) and counterclockwise (CCW) propagating modes. The measured period of the square-waves and is slightly longer than twice the roundtrip time in the external cavity. We analyze the regularity and the shape of the square-waves as a function of the pumping current and the feedback strength. Higher pump currents on the SRL lead to lower duty cycles of the square waves, while the period of the waveform remains the same. At higher feedback strengths, on the other hand, we observe square waves with irregular duty cycle, and then more complex waveforms. To understand the origin of these dynamical regimes, we rely on numerical simulations based on the Lang-Kobayashi equations. We demonstrate a novel mechanism leading to square wave oscillations based on the cross-feedback overcoming backscattering asymmetries present in the device's structure. Our numerical results are in close agreement with the experimental ones.

Modeling of Wind Energy in some Areas of Palestine

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The daily mean wind speed data for 4 locations in Palestine over the period of 5 years are collected, analyzed, and fitted to the Weibull distribution function. Weibull parameters are derived from the cumulative function of the observed data records (1997-2001), and used to calculate the mean wind speed and variance of the theoretical distribution. The second order polynomial is used to fit the relationship between the wind power and the mean wind speed. The monthly mean wind power density is higher during summer and lowers during winter except Hebron is higher in winter and lower in summer months. The highest mean power values are 33 W m-2 in January and 38 W m-2 in July for Hebron and Nablus respectively, whereas the lowest mean power is 1.66 W m-2 in January for Jericho. The adjusted R2 of the polynomial fit is 99.8 for all stations except Hebron 70%.

Accelerating Sensitivity Computation using Collocation on Finite Elements in NMPC

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Nonlinear model predictive control (NMPC) is one of the increasingly used algorithms in control systems. The main idea behind NMPC is finding online a control formulation that solves the finite optimal control problem subject to model equations and constraints involving states and controls. This methodology is done by measuring or estimating the states variables at the current time. Then we use these values in calculating the control profiles by solving an open-loop optimal control problem. The first part of the control profiles will only be applied to the plant until new measured or estimated state values are available for a new cycle of control computation and then reuse the new values to calculate new control profiles etc...

Several methods are available to solve the optimal control problems such as dynamic programming, indirect methods and direct methods. In all of direct methods the optimal control problem is normally transformed into a nonlinear programming (NLP) problem.

This NLP problem can be solved iteratively by using a sequential quadratic programming (SQP) method. Each SQP iteration needs the discretized objective function value of the NLP problem and its gradient, the values of the discretized equality and inequality constraints as well as the Jacobean matrix of these constraints. As an example of a direct method, we review the multiple shooting algorithm which is proposed by Bock and Plitt and converts the optimal control problem into an NLP problem by dividing finite time horizon into N equal subintervals. The original formulation of this methodology was realized using a well-known code MUSCOD. In this realization, the state trajectories are found by integrating the ordinary differential equations (ODEs) of the system model with an ODE solver and then using the chain-rule for the sensitivity computation. This approach is known by an internal numerical differentiation algorithm (IND) for approximating the state trajectory in each discretized interval and for solving the sensitivity of these trajectories with respect to initial values of the state and to the parametrized control, respectively. In IND algorithm, each multiple shooting interval was divided into finite subintervals with the width that must be chosen small value. If the width is large, then the round-off and truncation errors will become significant rather than the computational expense is high. In this study, we compute the state trajectories using collocation on finite elements. In addition, we compute the gradients (sensitivities) information for the NLP solution by taking a Taylor expansion of the functions of the state variables. This approach will take less time to compute the sensitivities if this compared with that in IND approach. As a natural result of this, the time taken for NLP problem solution will be reduced and accordingly the solution of the optimal control problem will be faster which makes the NMPC formulation is more applicable in different processes. Finally, a demonstrative example to show the efficiency of the proposed approach will be presented.

Indoor Radon Concentration Levels in 33 Schools Situated in Five Districts of the North Eastern of Hebron Province - Palestine

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In this present work, the indoor radon concentration, the annual effective dose rate and the annual equivalent dose to the lung and the populace risk were estimated in 33 elementary and secondary schools in Directorate of Education in the Northern of Hebron province-Palestine, during the summer months from June 2009 to September 2009. CR-39, Solid State Nuclear Track Detector (SS-NTD) technique was used for the measurements were for a period of 3 months. The investigation was focused on area, ventilation, windows, fans, type of construction (Building old and new) and floor number. Three classrooms, one each from first floor, second floor and third floor were chosen from each school making a total of 513 classrooms and other rooms. In most of the rooms, two detectors were used to measure the average concentrations of radon as well as radon and its progeny to allow the calculations of the average annual effective dose rate, and the radon content of the lung air in the area under investigation. The results show that the total average radon concentration levels of Bani Na'im city, Sa'eir city and Al-Shioukh, Shioukh Alaroub and Kuaziba sites are 71.6, 69.0 and 72.5 Bq/m3, respectively. These values lead to the average annual effective dose rate 0.45, 0.44 and 0.46 mSv y-1, respectively. The annual equivalent dose rate to the lung in the studied area was 5.73×10^{-8}, $5.52\ \times10^{-8}$ and $5.80\ \times10^{-8}$ Sv/y, respectively. These values are within the ICPR recommended values and the results show no significant radiological risk for the pupils and stuffs in the schools under investigation. Consequently, the health hazards related to radiation are expected to be negligible.

Record Values from Marshall-Olkin Exponential Distribution

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Marshall-Olkin exponential distribution has been established and studied by Salah, et, al. (2008). In this paper, we study the record values from Marshall-Olkin exponential distribution, in order to that we derive several relations for record values from Marshall-Olkin exponential distribution, these relations may then be used to compute all means, variances and covariances of record values based on Marshall-Olkin exponential distribution. Finally we estimate the location and scale parameter of Marshall-Olkin exponential distribution by using the information matrix.

Day 3 Wednesday July 18^{th} 2012

Session 5A
Time: 08:50 am - 09:30 am
Plenary Talk
Chair: Saber Elayadi

A Continuous Structured Model for Amphibians: Numerical Approximation and Parameter Estimation

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Major declines and sometimes extinction of many amphibian populations have been reported around the world. Causes attributed to such declines or extinction include habitat destruction, climate change, diseases, pollution, and introduced species. There is now growing recognition of the need for long-term monitoring of amphibian populations to address questions related to the extent of such declines. In 2004, we initiated a capture-mark-recapture (CMR) field sampling to understand the dynamics of an urban green tree frog population (Hyla cinerea). Every year during 2004-2011 we monitored this frog population from March through September or October. Such a monitoring period begins when the green tree frogs are just coming out of hibernation and before the breeding season, and it extends past the breeding season. A statistical methodology was developed to obtain point and interval estimates of this population from the CMR field data.

In this talk, a model which describes the dynamics of this amphibian population is presented. The model is composed of two nonlinear first-order hyperbolic partial differential equations, one describing the dynamics of juveniles (tadpoles) which are structured by age and another describing the dynamics of adults (frogs) which are structured by body-length. An infinite-dimensional least-squares approach which compares the population model to the statistical population estimates obtained from the CMR field data is presented. To solve the least-squares problem, first and second order explicit finite-difference approximations are developed. Convergence of the difference schemes to the unique (bounded variation) weak solution is established. Numerical results are presented to show that the designed order of accuracy is achieved. Parameter estimates for the vital rates of juveniles and adults are obtained, standard deviations for these estimates are computed and the sensitivity of the model to these parameters is investigated. These estimates are then used to demonstrate possible scenarios of the long term behavior of this population.

Session 9B
Time: 09:30 am - 11:00 am
Mathematics
Chair: Iyad Suwan

Global Well-Posedness of an Inviscid Three-dimensional Pseudo-Hasegawa-Mima Model

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The three-dimensional inviscid Hasegawa-Mima model is one of the fundamental models that describe plasma turbulence. The model also appears as a simplified reduced Rayleigh-Bénard convection model. The mathematical analysis of the Hasegawa-Mima equation is challenging due to the absence of any smoothing viscous terms, as well as to the presence of an analogue of the vortex stretching terms. In this talk, we introduce and study a model which is inspired by the inviscid Hasegawa-Mima model, which we call a pseudo-Hasegawa-Mima model. The introduced model is easier to investigate analytically than the original inviscid Hasegawa-Mima model, as it has a nicer mathematical structure. The resemblance between this model and the Euler equations of inviscid incompressible fluids inspired us to adapt the techniques and ideas introduced for the two-dimensional and the three-dimensional Euler equations to prove the global existence and uniqueness of solutions for our model. This is in addition to proving and implementing a new technical logarithmic inequality, generalizing the Brezis-Gallouet and the Berzis-Wainger inequalities. Moreover, we prove the continuous dependence on initial data of solutions for the pseudo-Hasegawa-Mima model. These are the first results on existence and uniqueness of solutions for a model that is related to the three-dimensional inviscid Hasegawa-Mima equations.

Joint work with C. Cao and A. Farhat.

On the Stability of Evolution Galerkin Schemes Applied to a Multi-Dimensional Wave Equation System

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The subject of the contribution is to study and analyze the stability of the evolution Galerkin schemes for a multi-dimensional wave equation system. Von Neumann analysis will be applied and Fourier transformation will be used to estimate the stability limits of such schemes.

Multiscale Modelling and Simulation: From Quantum to Continuum Representations of Matter

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A major objective for both materials and life sciences modelling and simulation is to be able to span vast length and time scales in order to accurately describe temporal and spatial behaviour of systems at the macroscopic level in terms of the atomic and molecular composition of the components involved. In this talk we describe the scientific and technological obstacles faced in confronting this challenge.

Our approach is illustrated through a major scientific problem arising in nanomaterials science. Clay-polymer nanocomposites are a new range of particle-filled composite polymer materials with important interactions over many different length scales, ranging from the quantum mechanical level to the macroscopic. Multiscale modelling and simulation is therefore an important approach which can be used to understand and, ultimately, to predict the properties of such composites from their constituent components. We describe multiscale simulation scenarios in which we couple molecular dynamics simulations running on several different length and time scales. In the loosely-coupled scheme, there is a unidirectional coupling of one level to the next in terms of increasing length and time; in the tightly-coupled scheme we choreograph a similar hierarchy of simulations which exchange input and output data bi-directionally and run concurrently. We present some of the first results to emerge from our loosely-coupled simulations running across distributed production e-infrastructure (consisting of an EU PRACE Tier 0 supercomputer, an EGI grid resource and a local cluster at UCL).

Session 7C
Time: 09:30 am - 11:00 am
Physics
Chair: Hazem Abusara

Ion Outflow at High-Altitude and High-Latitude Region: The effect of Wave - Particle Interaction

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At large latitudes the geomagnetic field lines are stretched such that the ionosphere and magnetosphere are connected; the resulting transfer of mass and energy between low and high altitudes plays an important role in ionosphere/magnetosphere coupling. Several models have been suggested to investigate the behavior of H^+ and O^+ ions outflows in the polar wind and auroral region in order to understand the dynamic structure of the magnetosphere, the ionosphere/magnetosphere coupling, the ionosphere/magnetosphere response to solar activities, and consequently to find out the mechanism that is responsible for ions energization in the polar regions. The purpose of this talk is to review the observations related to O+ and H+ ions outflows in the polar wind and auroral region in order to compare it with the corresponding simulations obtained by using Barghouthi model (Barghouthi, 2008). We expect from this comparison to provide a mechanism that is responsible for producing the observed characteristics of ion outflows in the polar wind and auroral region. In particular we want to improve our understanding of the role of wave-particle interactions in both regions, and highlight the role of finite wavelength (i.e. the wavelength of the electromagnetic turbulence) effects and how these affect the observed ion velocity distributions and the altitude distributions of the ion moments.

Tuning Optical, Magnetic and Other Interesting Properties of Nanoalloys for Energy Applications

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Plasmonic nanostructures are possible candidates for reducing the thickness of the photovoltaic absorber layers. Metallic nanoparticles, for example, could be tailored to couple and trap freely propagating plane waves from the Sun into an absorbing semiconductor thin film, or serve as sub-wavelength antennas in which the plasmonic near-field is coupled to the semiconductor. In this talk, after a brief review of the challenges and opportunities in the rational design of nanoalloys for various application, I will present results obtained using the time dependent density functional theory (TDDFT) approach to examine the optical properties of arrays of metal chains consisting of 6-30 atoms of Au or Ag and those doped with transition metal (TM) atoms (Ni,Rh,Fe, Pd). Calculations indicate that in the presence of doping, the system acquires one or more local excited states close in energy to the extended plasmon peak, which is especially pronounced in the case of Ni-doped chains. Furthermore, single chains of some transition metals are also found to support collective optical excitations. The case of double and triple TM doped Au chains is even more interesting as the plasmon frequencies could be tuned to lie in the visible.

Secondly, I will examine the electronic structure and vibrational properties of the free-standing core-shell (Cu@Ag) AgnCu34-n (n = 0_34) nanoalloy family as a function of stoichiometry using ab initio total energy electronic structure calculations. Our calculations show that progressive alloying significantly alters the coordination distribution, bond lengths, formation energies, and the electronic densities of states. Changes in coordination and elemental environment are reflected in the electronic densities of states, which broaden or narrow as a result of hybridization between the Cu and the Ag atoms. The densities of states of Ag atoms in Ag-rich nanoparticles show large broadening when a single Cu atom is introduced, followed by substantial deviation of the position of the center of d states from that of the pristine (Ag34) nanoparticle. Such deviation is found to persist for nonsymmetric nanoparticles. The calculated HOMO_LUMO gaps vary between 0.2 and 0.9 eV within the family. The magnitude of the gaps is found to depend on the extent of symmetry in the geometric structure: the particles with no overriding symmetry have smaller gaps, whereas those with higher symmetry display larger gaps.

Additionally, I will show that by combining DFT with dynamical mean field theory (DMFT) we obtain quite reliable results for the magnetic properties of sub-nm sized Fe, Pt and Pt/Fe nanoparticles. The code that we have developed for the process should be applicable to larger systems.

[1] Work done in collaboration with V. Turkowski, N. Nayyar, A. Kabir, and M. Alcantara-Ortigoza and supported by US-DOE Grant DE-FG02-07ER46354

Future Galaxy Surveys and Possible Constraints on the Underlying Theory of Gravity on Large Scales

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The accelerating expansion of the Universe cannot be explained by matter with an ordinary equation of state in the context of the General Theory of Relativity (GR). A plethora of models for the accelerating expansion in terms of modifications to GR and of matter with nonstandard equations of state, have been put forward. These models will also change the way the large scale distribution of galaxies has evolved. Therefore, significant constraints on the underlying theory for gravity and for dominant form of matter-energy of the Universe will be derived from large scale future data of the distribution of galaxies. Some of the methods for achieving these goals will be discussed.

Session 10B
Time: 11:20 am - 12:40 pm
Mathematics
Chair: Safa Hamed

Price Impact and Market Indifference Prices with Power Utilities

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This work is within the field of financial mathematics and it is concerned with questions of market liquidity, investigating both price formation and replication of options in illiquid markets. The methods which are applied are mainly those of stochastic analysis and economic equilibrium theory.

We investigate the price impact of large transactions in an equilibrium pricing model with HARA utility functions. A market maker trades with a large investor at a price that allows him to preserve his expected utility, the so-called market indifference price. In this setting we look at marginal prices and illiquidity premia in comparison to the Black-Scholes model as well as hedging and replication of non-traded (OTC) claims.

Our model aims to bridge the gap between two commonly considered principles of price formation, namely economic equilibrium theory, where prices arise from within the model, and classical semimartingale models, where price dynamics are specified exogenously via some stochastic process. While using equilibria of expected utility as the principle of price formation, we apply methods of stochastic analysis to investigate questions concerning hedging and replication.

We find that whenever replication is possible, the replication price of an option corresponds to its market indifference price. We further show that the replication of a call option is possible under fairly weak assumptions and we proceed to consider the replication of a small quantity of call options which allows us to derive asymptotic results for the replicating strategy. It turns out that the first-order approximation to the replicating position corresponds in a certain sense to the Black-Scholes delta while the second-order approximation, which can be viewed as the liquidity correction of the hedge, is directly linked to the sensitivities (with respect to price changes in the underlying) of the liquidity corrections of the prices of both the option and the underlying itself.

The Tribonacci p-Numbers and the Tibonacci p-Triangle

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The tribonacci p-numbers which generalize the tribonacci numbers are defined by

$$T_p(n+2) = T_p(n+1) + T_p(n) + T_p(n-p).$$

The tribonacci p-triangle is constructed from the array of tribonacci p-numbers in a manner similar to that of the Pascal's triangle but with more complicated row-column sums. We derive several explicit formulas for the tribonacci p-numbers using the tribonacci p-triangle.

Non-Hermitian Potenials with Real Eigenvalues by Asymptotic Iteration Method

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It is well known that the quasi exact solvable eigenvalues of the Schrödinger equation with the potential as well as the periodic potential are real for the PT-invariant non- Hermitian potentials in case the parameter is any odd integer. In this work we used the Asymptotic Iteration Method (AIM) to obtain the eigenvalues of the same potentials without any restrictions of the quasi exact conditions, for any number.

Local Huber M-Estimates with Regularization

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Mr'azek et al. (2006) proposed a unified approach to curve estimation which combines localization and regularization. I will use this unified approach to study some asymptotic properties of local smoothers with regularization. In particular, I shall discuss the Huber M-estimate and its limiting cases towards the L2 and the L1 cases. For the regularization part, I will use quadratic regularization. Then, I will define a more general class of regularization functions. Finally, I will show a Monte Carlo simulation study to compare different types of estimates.

Session 8C
Time: 11:20 am - 12:40 pm
Physics
Chair: Mohammed Abu-Samreh

Effect of Sample Temperature on Photoluminescence (PL) Centers in Er-Doped SiyO1-y (y⩾0.32) Thin Films

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Of interest in silicon photonics are erbium doped SiyO1-y (y⩾1/3) thin films containing excess silicon in the form of Si nano-clusters (Si-ncls) which have been shown to exhibit sensitized photoluminescence (PL) near 1540 nm emitted through the 4I13/2 to 4I15/2 transition of the Er3+ ion. The wide-band forms of Si, such as amorphous Si (a-Si), and Si-ncls in SiO2 , reduce the thermal quenching of Er luminescence, reduce the thermal population of the conduction band and decrease energy back-transfer by ensuring that the sensitizing electron-hole pair has a larger energy than the 4I13/2 a*prime* 4I15/2 transition of the Er3+ ion. Room temperature light emission in Er-doped SiyO1-y containing Si-ncls, resulting from a strong coupling between the Si-ncls and Er3+ ions, has been widely reported. However, in this material, efficient Er3+ PL emission relies on the suppression of competitive de-excitation channels in the sensitizing species. If Er3+ is excited by energy transfer from Si-ncls, then the Er-PL near 1540 nm and the visible or near-infrared luminescence due to band-to-band transitions in Si-ncls should be correlated depending on the number of active Er3+, excitation energy, power, and temperature. The overall efficiency of Er3+ in this case, is primarily limited by the distance dependence of the energy transfer, and the spectral overlap of excitonic states in Si-ncl or localized sensitizers and accessible 4f-states of Er3+, necessary for energy conservation. Moreover, it has been shown that defects due to excess Si in silica act as luminescence sensitizers.

Towards Quantifying the Impact of Blood Rheology Model on Shear Stress Estimates Throughout the Cardiac Cycle

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Blood is a shear-thinning fluid, which flows only when subject to stresses greater than a certain yield stress. This rheological behaviour arises from the presence of red blood cells suspended in a medium known as blood plasma (mostly made of water). Despite this fact, a large body of literature concerning haemodynamics characterises blood as a Newtonian fluid under the assumption that in large arteries the shear rate is large enough for the viscosity to remain constant. More recently, it has been suggested that, in intracranial aneurysms, this simplification overestimates wall shear stress. Therefore, applications requiring accurate shear stress (SS) estimates (e.g. those concerning vascular remodelling and biomechanics) will suffer from modelling inaccuracy unless the generalised Newtonian (GN) properties of blood are taken into account.

In this work, we analyse the impact of choice of rheology model on the estimates of SS of a parallel lattice-Boltzmann haemodynamics solver (namely HemeLB). So far, similar analyses have been carried out in idealised two- and three-dimensional geometries and to a lesser extent in complex vascular networks obtained from patient-specific data. Furthermore, little evidence exists about how the variation in blood peak velocity throughout the cardiac cycle affects SS distribution. We show that the difference in SS estimated by GN and Newtonian rheology models varies considerably during the cardiac cycle. More precisely, this difference becomes particularly evident during diastole, when the velocity magnitude is lowest.

Characterizing Amorphous-Crystal Switching of Ge2Sb2Te5 Phase Change Material

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The Capacitance variation with applied voltage (C-V) is used to characterize the switching mechanism between amorphous and crystalline states in thin films. The measurements were performed for a sweep of voltages from -20 to +20 volts at different temperatures. The capacitance was found to depend on temperature and frequency. The capacitance of Ge2Sb2Te5 film decreases as the bias voltage increases in the amorphous and crystalline states. This effect has been observed at all temperatures in the crystalline sample, while in the amorphous sample the effect appears only at temperatures close to the amorphous-crystalline transition temperature. Negative capacitance values are observed in the crystalline state at high bias voltage. This effect might be attributed to a significant increase in the films conductivity due to temperature and applied bias voltage. The nonlinearity in the capacitance and conductivity could be related to the nucleation and growth mechanism as the temperature becomes close to the amorphous-crystalline transition temperature.

Electrical Transport in Graphene Layers

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Graphene is a single layer of carbon atoms tightly packed into a two-dimensional (2D) honeycomb lattice, and is a basic building block for graphite material. In this project, the mechanical exfoliation method was used to produce graphene layers from parent graphite. Si wafer was used as a substrate with a precise 300nm oxide layer on top. Optical microscopy, namely through interference contrast, was used to initially identify graphene existence. After that, Atomic force microscopy and Raman spectroscopy were used to determine the number of layers of graphene. Electron beam and optical lithography were used to make metallization contact the graphene with special electrodes. Standard hall measurements were performed with a perpendicular magnetic field. The value of the magnetic field was varied between -8 to 8 Tesla. The resistance (R_{xx} and R_{yx}) was measured as a function of the magnetic field with temperature as a parameter. The dependence of Shubnikov de Haas Oscillation on temperature was studied. Different parameters such as effective mass and carrier density were

Session 6A
Time: 02:00 pm - 02:40 pm
Plenary Talk
Chair: Ulrich Eckern

Review of Optical Left-Handed Waveguide Sensors

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In recent years, two different types of materials are being developed in the area of nanotechnology and Material Science, Metamaterials and photonics crystals. Metamaterials are engineered composites that exhibit superior properties that are not found in nature and not observed in the constituent materials. Metamaterials (sometimes termed left-handed materials (LHMs)) are artificial materials whose real parts of permittivity and permeability are both negative and consequently have negative index of refraction. These materials were theoretically discussed over 40 years ago. More recently, the realization of such materials, consisting of split-ring resonators (SRSs) and continuous wires have been done and found. Photonic crystals (PCs) are often called semiconductors for light. In a semiconductor there is a bandgap for electrons between the valence band and the conduction band. Electrons having energies in the bandgap are not allowed in the semiconductor crystal. Due to the negative index, metamaterials have been subjected to research interest in the field of optoelectronics because they are promising for a variety of optical and microwave applications, such as new types of modulators, band pass filters, lenses, and microwave couplers and sensors.). Surface sensing has been used for the detection of ultrathin biological molecular layers of thickness much smaller than the wavelength of the guided light. Such a sensing scheme is currently the subject of keen interest in pharmaceutical applications such as immunoassays. It is also of interest in chemical sensing schemes where the opto-chemical transuding mechanism involves an ultra thin surface layer. Homogeneous sensing has a wide range of applications such as detection of harmful gases (methane, CO2, SO2), monitoring pollutants in water and detecting the concentrations of certain chemical in blood. In a recent application of Metamaterials or LHMs, Shabats group showed by simulation that using a thin layer of LHM between the guiding layer and the cladding layer can dramatically enhance the sensitivity of slab waveguide sensors. In our work, we present theoretically various waveguide structure in which one of the layers is assumed to be a lossy LHM or photonic crystals with both the and are simultaneously negative and complex. We assume that the multilayer waveguide is operated as an optical sensor in reflected mode. We propose various optical waveguide sensor structure containing left-handed materials. The structure under consideration consists of a thin film made of a left-handed material surrounded by at least one kerr-type nonlinear medium. We also theoretically investigate the possibilities to design optical waveguide structures containing left handed photonic crystals. The sensitivity of the proposed sensors are derived and their dependence on different parameters of the structure is shown. Finally, we explore some interesting properties of nonlinear waveguide sensors containing different types of left handed materials and photonic crystals..

Session 11B
Time: 02:40 pm - 04:00 pm
Mathematics
Chair: Yousef Manasreh

A Unified Continued Fraction Algorithm in a Non-Archimedean Field

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In the real case, Y. Hartono, C. Kraaikamp and F. Schweiger, constructed a continued fraction expansion for each $x \in (0,1)$, referred to as its Engel continued fraction expansion, of the form

$$x = [0 : 1, c_1; c_1, c_2; \ldots; c_{n-1}, c_n; \ldots] = 0 + \frac{1}{c_1+} \frac{c_1}{c_2+} \cdots \frac{c_{n-1}}{c_n+} \cdots ,$$

where $c_n \in N$ are subject to $1 \leq c_n \leq c_{n+1}$ $(n \geq 1)$. We present here a unified algorithm, to construct a continued fraction expansion for each element α in a discrete-valued non-archimedean field $(K, |\cdot|)$, of the form

$$\alpha = [a_0 : b_1, a_1; b_2, a_2; \ldots; b_n, a_n; \ldots] = a_0 + \frac{b_1}{a_1+} \frac{b_2}{a_2+} \cdots \frac{b_n}{a_n+} \cdots ,$$

where $a_0 \in K$ and $a_n, b_n \in K \setminus \{0\}$ are subject to $|a_n a_{n+1}| > |b_{n+1}|$ $(n \geq 1)$. Several examples are given to show that our algorithm yields almost all known continued fraction expansions as special cases.

Productivity of P-Spaces

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Two problems have been solved in the MSc thesis titled "Compactness and Lindelofness of a Topology With Respect to Another" and presented in July 2011 at Math Dept at Al-Quds University, by "Faten Turkman" and supervised by : "Yousef Bdeir, PhD." The first problem was the productivity of P-spaces which was discussed in "Product Properties for Pairwise Lindelof Spases", by "Adem Kilicman and Zabidin Saleh". Adem and Zabidin claimed that the product of P-spaces is P-space and gave a "proof" for that. A counter example for that is given. The second problem was the existence of a countable inadequate family D of members of a topology Á with respect to another topology ϕ with no maximal countable inadequate family of members of Á with respect to ϕ and containing D.

Asymptotic Behaviour of Solutions of a Second-Order Nonlinear Differential Equation

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The asymptotic behaviour of solutions of a nonlinear differential equation of second order has been widely studied by M. Naito, A.Mingareilli, W. Trench,K. Kiguradze, J. Tong,Z. Nehari, J. Wong , G. Hovhannisyan and many others.

In this paper We consider a class of sublinear differential equation of second order where the coefficient of nonlinear term is a bounded function for all sufficiently large in R. For this equation We obtained Sufficient conditions for boundedness and convergence of all solutions to zero as tends to infinity.

Parametric Maximum Likelihood Estimation of Cure Fraction Using Interval-Censored Data

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A significant proportion of patients in the cancer clinical trials can be cured, that's, the symptoms of the disease disappear completely and the disease never recurs. In this article the focus is on estimation of the proportion of patients who are cured. The parametric maximum likelihood estimation method was used for estimation of the cure fraction based on application of the bounded cumulative hazard (BCH) model to interval-censored data. We ran the analysis using the EM algorithm considering two cases: i) when no covariates were involved in the estimation, and ii) when some covariates were involved. This paper shows derivation of the estimation equations for the cure rate parameter followed by a simulation study.

Session 9C
Time: 02:40 pm - 04:00 pm
Physics
Chair: Mohammad Elhilo

Detecting Blood Vessels in the Retinal Images

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Nowadays, the key term for improving the diagnosis and treatment of different diseases is using modern technologies. One of these important approaches is the use of medical image processing; here we discuss a specific problem, blood vessels in retinal images, where the fundus camera gets colored pictures. Applying one of the proposed algorithms on the processed picture in order to have the corresponding binary picture that has the shape and width of the vessels, the physician can diagnose the abnormal conditions in the retina, for instance, diabetic retinopathy is an example of the complications, and hence draw the most plausible conclusions. Discussed Algorithms and Suggested work Here, are introduced some of the algorithms that were proposed and implemented to identify the retinal vessels; these can be generally classified into two main categories:

1. Detection of Blood Vessel Boundaries and
2. Extraction of the Core Area of the Blood Vessel Tree by Tracing Vessel Centers.

Each method (algorithm) of these has its different techniques; and in order to compare their results, are used standardized qualification terms including the sensitivity, specificity, accuracy, the maximum average accuracy, and kappa values (a measure for observer agreement). In addition to these criteria, the computational time in applying some of these algorithms is also compared. This will show the advantages and the points of strength and weakness of each algorithm. Through scheming the different algorithms, it is noticed that the methods may be improved in two directions: the precision, and efficiency of the algorithm. Improvement is essentially achieved by specifying optimal values for the different parameters and enhancing others.

Charge-State Distributions of 0.4-2.0 MeV 4He Ions Backscattered from Kr Gas Target

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Charge-state distributions (CSD) of 4He ions backscattered at 90^o from Kr gas target were investigated for impact energies varying from 0.4 to 2.0 MeV. The distributions resulting from these violent ion-atom collisions were found to be insensitive to the incident ion charge-state within the investigated energy range. Moreover, the distributions were strikingly identical to distributions reported in the literature resulting from backscattering of He ions from and transmission of He ions through solid targets. The findings suggest that, for both gas and solid targets, the memory of the incident ion charge-state is lost during the early stages of the interactions and that the final charge-state distribution is determined during the final stages. A semi-classical theoretical approach based on the early Bohr theory and suggested by Bianconi et al. was applied and accounted reasonably well for the experimental results despite the simplicity of the approach and the complexity of the interactions.

The present Rutherford backscattering spectrometry (RBS) experiments were performed using the University of Jordan Van de Graaff Accelerator (JU-VAC).

Fragility of Ge40S60 Glass Forming Liquid

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From differential scanning calorimetry (DSC) measurements performed on Ge40S60 chalcogenide glass forming liquid, the values of the apparent activation energy h*, and the fragility index, m, as defined in the strong-fragile glass forming liquid concept, have been determined. The calculated value of m for this glass forming liquid is equal to 82. From this m value, it is suffice to conclude that this glass forming liquid belongs to an intermediate category that exhibits a kinetic behaviour between strong and fragile.

Memristor: Modeling the Underlying Device Physics and Application

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The realization of the missing fourth fundamental Electrical element by Hewlett-Packard in 2008, the memristor, adds new promising technology that enables the continuing improvement of performance, power and cost of integrated circuits and keeping Moores law alive. Memristor-based technology provides much better scalability, higher utilization when used as memory, and overall lower power consumption. This paper presents a detailed study of existing memristor modeling using both Matlab. We studied three different models to predict the behavior of the memristor device. We developed the Matlab algorithms for all models and analyzed them for their compatibility with the experimentally established characteristics of HP memristor, as well as their viability for use in memory circuits. We discussed all the difficulties with these models and adopt a modified model that gives more realistic description of a memristor device. We used this modified model to build a hybrid memrisrot-CMOS memory cell and proposed a non volatile memory architecture that can be used for both on-chip or as a stand alone memory.

Session 12B
Time: 04:15 pm - 05:30 pm
Mathematics
Chair: Fathi Allan

A Generalized Synthetic Division

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We generalize the synthetic division to a divisor of degree greater than one. For this purpose we arrange the coefficients of the dividend and the divisor in an efficient array to simplify and to avoid the complications of the manual calculations that may occur in using the division algorithm.

Some Norm Inequalities for Kronecker and Hadamard Products

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In this thesis we introduce Some Norm Inequalities for Kronecker and Hadamard products, these result involve algebraic properties, eigenvalues, singular value and singular value decomposition, the kronecker sum of matrix, the vec-vector, the hadamard product of matrices and norms. The Inequalities for Kronecker and Hadamard products of positive definite matrices are discussed. A number of Inequalities involving powers, kronecker powers, and hadamard powers of linear combination of matrices are presented. Holder Inequalities and arithmetic mean-geometric mean Inequalities for Kronecker and Hadamard products are obtained as special cases. Bounds on the spectral radius of Hadamard products of positive operators on lp-spaces are discussed.

Special Boundary Integral Equations for Potential Problems in Multi-Dimensional Regions

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This talk deals with the approximate solution of Laplace's equation in two-dimensional regions with circular holes and in three-dimensional regions with slender cavities with circular cross sections. The proposed method, Special Boundary Integral Equations Method (SBIEM), introduce approximate solutions to the Laplace's equation. The solution on the boundary of each circular hole is represented by a finite sum of circular harmonics with unknown coefficients. The hole geometry is directly exploited in a new set of integral equations with special kernal functions which independently " pick out" these coefficients. Each new integral equation contains only one coefficient relating to the particular hole and the resulting system of equations is solvable. The accuracy of the obtainable approximate solution depends on the number of circular harmonics used in the representation series of the solution on the boundary of the hole. We consider in this thesis two level of approximations. The first one is called the zeroth order level and the second is called the first order level. Examples are given to demonstrate the proposed method (SBIEM).

Further, in this talk, complete general numerical methods are proposed to solve Laplace's equation, namely the collocation and the Galerkin methods. These me*thods* belong to the general frame work of projection methods. An important characterisation of these methods is that they are applicable regardless of the geometry of the domain of the Laplace's equation. A comparison between the results obtained by these methods and these obtained by the special boundary integral equations method are given in this talk.

The Positivity Problem for Fifth-Order Linear Recurrence Sequences is Decidable

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Consider a sequence (u_n) satisfying a fifth order linear recurrence of the form

$$u_n = a_1 u_{n-1} + a_2 u_{n-2} + a_3 u_{n-3} + a_4 u_{n-4} + a_5 u_{n-5} \quad (n \geq 5),$$

where $a_1, a_2, a_3, a_4, a_5 (\neq 0) \in \mathbb{Z}$. We are interested in the *Positivity Problem*: Is it possible to decide whether the sequence $(u_n)_{n \geq 0}$ is nonnegative? Equivalently, is it decidable whether $u_n \geq 0$ for all $n \geq 0$? The Positivity Problem for sequences satisfying a second order linear recurrence has already been shown to be decidable by Halava, Harju and Hirvensalo, in 2006.

The Positivity Problem for sequences satisfying a third or a fourth order linear recurrence has recently been shown to be decidable. It is shown here that the Positivity Problem for fifth order linear recurrence sequence is decidable.

A New Method for Solving a Non-Homogeneous Cauchy-Euler Differential Equation

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A new method is introduced to solve the non-homogeneous second order Cauchy-Euler differential equation, i.e an equation of the form

$$x^2y'' + Axy' + By = Q(x)$$

where A,B$\in$ R. In addition, the method is also generalized for higher orders.

Session 13B
Time: 04:15 pm - 05:30 pm
Mathematics
Chair: Henrique Oliveira

The Number of Periodic Solutions of Some Analytic Equations of Abel-Type

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New result are proved to estimate the number of periodic solutions of a differential equation of Abel type by using a modification of a technique introduced by Ilyashenko. The main tool is an estimate on the number of zeros of a holomorphic function. A concrete example is analyzed but the results are presented to make the method exible and applicable to other equations.

Conformal Mapping for Paramatric Surfaces

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Conformal mapping is a powerful mathematical method of analysis with many successful applications in modern scientific technologies. The purpose of this search is to rekindle interest in conformal mapping by illustrating its wide applicability and describing a new mathematical techniques. Its invaluable tool for solving problems in engineering and physics that can be expressed in terms of functions of complex variable exhibited on complex geometries.

Conformal mapping methods have attracted researcher in computational geometry and grid generation fields for the purpose of constructing domain discretization applied to a multitude computational engineering problems. Researchers have utilized conformal mappings in grid generation methods a mean to an end application in computational sciences.

Our main goal in this thesis is to present the development and application of an approach for formulating an elliptic generation system on parametrically defined surfaces. The present derivation of the surface equations proceeds in two steps: first, conformal mapping of smooth surfaces onto rectangular regions is utilized to derive first-order system of partial differential equations analogous to Beltrami system for quasiconformal mapping of planar regions. Second, a general elliptic generation system for three-dimensional surface is formulated based on Beltrami system and quasiconformal mapping. The overall effect of this approach is reliable and versatile elliptic method for the generation and improving surface grid descritization.

A Semi-Numerical Analytical Solution of Partial Differential Equations Using Reduced Differential Transformation Method

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The Reduced Differential Transform Method (RDTM) is an iterative procedure that provides an analytical approximation to various kinds of partial differential equations in a rapidly convergent sequence. The method is tested on different types of heat equations. The solution is easily and accurately calculated in the form of convergent power series. The very small relative error occurs after few numbers of iterations shows the powerful, efficiency, and effectiveness of the method.

An Inverse Problem Arising from Economics

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The problem of characterizing individual demand functions in microeconomics has been considered since about one century ago. It consists in giving the necessary and sufficient conditions to be satisfied by a given function in order to be an individual demand function. These functions arise naturally as solutions to certain optimization problems. The characterization problem leads to a certain type of inverse problems. We will review the basic individual model and the characterization problem stemming from it. We will also introduce some recent results in this domain. Our main mathematical tool will be exterior differential calculus.

Reflection on Information Sciences and Pedagogy

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In this research the author reflects on the impact of technology on teaching in higher education institutions represented here by the case of the UAE University (UAEU) in general and the Faculty of Information Technology (FIT) more specifically. UAEU is mostly an undergraduate institute with recent introduction of postgraduate programs. UAEU employs latest technologies (smartboards, iPADs, laptops, and various Internet-based tools and applications) to provide more effective instructions to students in order to facilitate teaching and at the same time, provide more hands-on to students in the classroom (i.e., laboratory). However, this is not a straight-forward-process and technology does impose challenges emanating from it in the first place but mostly arising from the context embedding technology. For example, a rule-of-thumb here points to the fact that a successful implementation of technology in one country (i.e., western country) does not necessarily lead to its success in another. Such context could span different constituents and stakeholders (teachers, students, administrators, policymakers and strategists, researchers, government, schools vs. colleges, etc.) and indeed, the issues could become more complex and if its mishandled, technology may fire back and lead to negative and catastrophic results. Consequently, technology becomes more of a curse than it is a bless and hence, impede the educational process rather than improving it. Thus, effective governance becomes very important here to control such amalgamated complexities in the educational sector and processes. Having said that, this is not an easy task and indeed, like opening a can of warms, matters could go out of control. Unfortunately, this is the case in most countries in the world where compromises and semi solutions and successes are the norm. Such wishful thinking could lead to the loss of educational values and to the demise of teaching which should put students at the heart of the educational process. Stemming from this background and as a focus here, this research will delve into technological impacts as well as students to shed more light into factors effecting learning in general and in the classroom.