# sdEA - III

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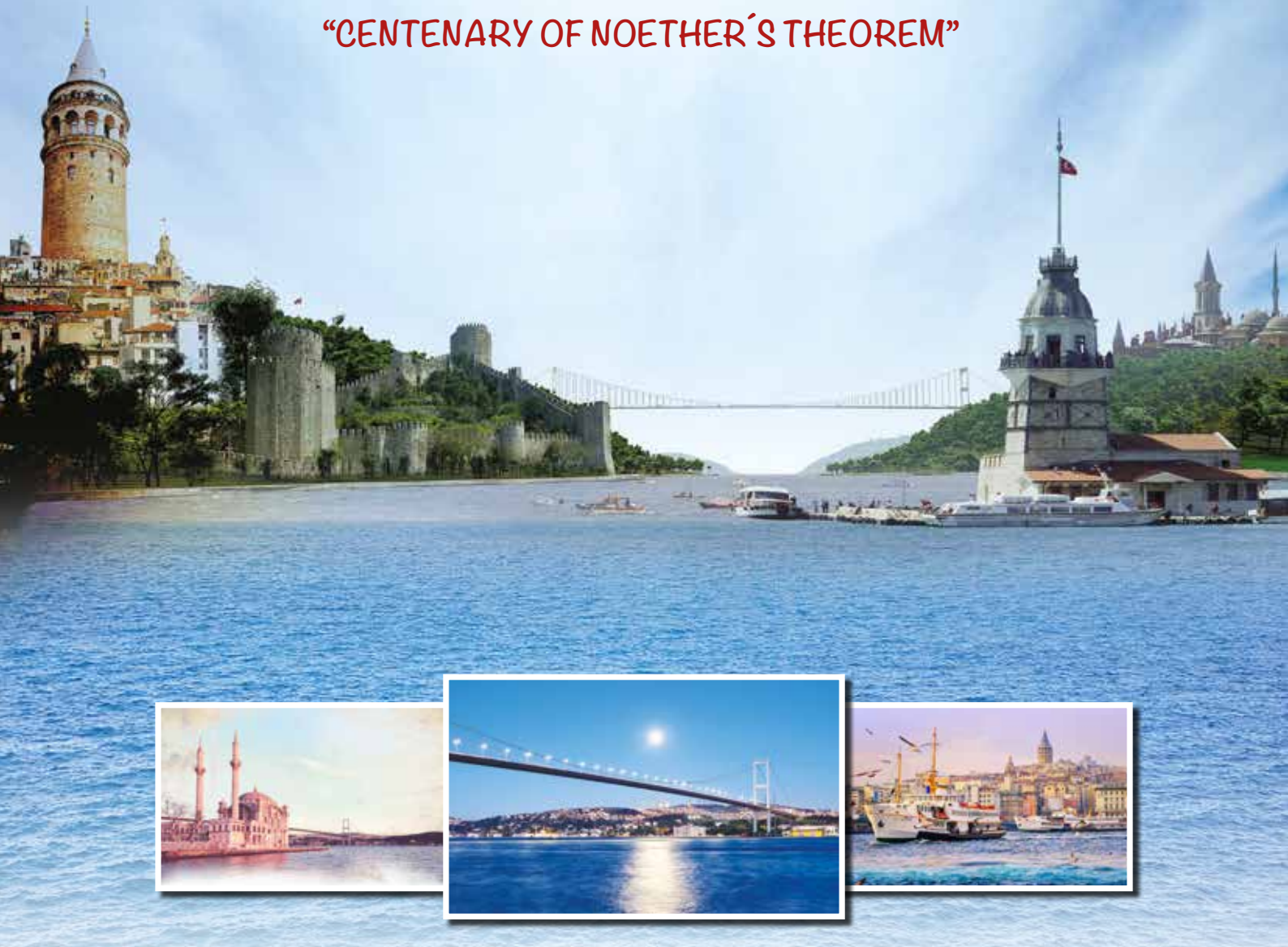
İSTANBUL TEKNİK ÜNİVERSİTESİ 1773

# 3rd INTERNATIONAL CONFERENCE ON SYMMETRIES, DIFFERENTIAL EQUATIONS AND APPLICATIONS

## 14-17 AUGUST 2017

## ISTANBUL TECHNICAL UNIVERSITY, FACULTY OF CIVIL ENGINEERING CONFERENCE HALL

"CENTENARY OF NOETHER'S THEOREM"



# ABSTRACT BOOK

## *PREFACE*

*We are pleased to organize III. International Conference on Symmetries, Differential Equations and Applications (SDEA-III) at Faculty of Civil Engineering Conference Hall, İstanbul Technical University, İstanbul, Turkey.*

*This event is the third conference in the series.*

*The first SDEA-I was held in Johannesburg, South Africa in 2012, dedicated to the Bicentenary of Evariste Galois.*

*The second SDEA-II was held in İslamabad, Pakistan in 2014, dedicated to James Clerk Maxwell´ Theory of Electromagnetism.*

*The third SDEA-III is dedicated to the Centenary of Noether's Theorem.*

*Noether's theorem, which was proven by Emmy Noether, states that every differentiable symmetry of the action of a physical system corresponds a conservation law.*

*Noether theorem is one of the critical parts of the modern physics based on the connection between symmetries and conservation laws.*

*The main purpose of this conference is intended to concentrate on the recent advances in the applications of Lie groups including a wide area of topics in interdisciplinary studies in theoretical and applied sciences from mathematical physics to financial mathematics by bringing together academicians who are working on a variety of applications of Lie groups.*

*The topics of the conference are Noether's Theorem, Lie Theory and Symmetry Methods, Lie Algebras and Lie Pseudogroups, Super-Symmetry and Super-Integrability, Representation Theory of Lie Algebras, Classification Problems, Conservation Laws, and Geometrical Methods. We are planning that SDEA-III would be a conference by providing a productive forum for academicians and students from not only mathematics and physics but also other branches such as engineering and social and experience a valuable technical program and a magnificent city.*

*We would like to thank the conference organizing committee members and external referees for volunteering their time to review and discuss submitted abstracts.*

*We would like to extend special thanks to the invited speakers: Professor Akbar, Professor Cheviakov, Professor Gürses, Professor Kac, Professor Kalantarov, Professor Khalique, Professor Meleshko, Professor Muriel, Professor Nucci, Professor Olver, Professor Soltanov, Professor Reid, and Professor Vinogradov.*

*We would like to thank to conference sponsors: İstanbul Metropolitan Municipality, Sarıyer Municipality, İstanbul Technical University, International Mathematical Union, Turkish Airlines and The Scientific and Technological Research Council of Turkey making SDEA-III a successful event.*

*I would like to point out that SDEA-III is in corporation with SIAM, Society for Industrial and Applied Mathematics.*

***In this conference, there will be 18 parallel sessions with 76 presentations and 66 speakers including 14 invited speakers from 16 different countries and 17 poster representations during 4 days.***

*The selected papers of SDEA-III conference will appear in Journal of Physics: Conference Series (JPCS) and The Springer Proceedings Book Series.*

*Finally, I would like to thank DEKON staff for organising this event and ensuring it ran so smoothly.*

*I personally wish to express my gratitude to all participants for coming to İstanbul and sharing their research results in this scientific event.*

*Sincerely,*

*Prof. Dr. Teoman Özer*
*Chair of SDEA-III, 2017*

## August 14, 2017 Monday

| | Main Hall | Hall 2 | Hall 3 |
|---|---|---|---|
| 10:00-10:30 | **Opening Session** | | |
| 10:30-11:30 | **Invited Speaker 1:**<br>**Moderator: Ayşe Hümeyra Bilge**<br>**Prof. Peter Olver**<br>University of Minnesota, USA<br>Title: Emmy Noether: Symmetry and Conservation | | |
| 11:30-12:00 | **Coffee Break** | | |
| 12:00-13:00 | **Invited Speaker 2:**<br>**Moderator: Elman Hasanoğlu**<br>**Prof. Sergey Meleshko**<br>Suranaree University of Technology, Thailand<br>Title: Symmetries of equations with nonlocal terms | | |
| **13:00-14:00** | **Lunch** | | |
| 14:00-15:00 | **Invited Speaker 3:**<br>**Moderator: Burak Polat**<br>**Prof. Mohammad M. Akbar**<br>University of Texas at Dallas, USA<br>Title: Symmetries of the Einstein Equations for Static Axisymmetric and Cylindrical Gravitational Wave Systems in Vacuum and Ricci Solitons | | |
| 15:00-15:30 | **Coffee Break** | | |
| 15:30-16:50 | **Session 1**<br><br>**Moderator:**<br>**Özlem Orhan**<br><br>• **Giovanni Rastelli**<br>*Superintegrability and Quantization*<br>• **Claudia Maria Chanu**<br>*Extended Hamiltonians and shift, ladder functions and operators*<br>• **Ilmar Gahramanov**<br>*Hypergeometric beta integrals: from supersymmetric dualities to the Painleve equations* | **Session 2**<br><br>**Moderator:**<br>**Saadet Özer**<br><br>• **Saida Bakht**<br>*Modelisation, Mathematical Analysis and Numerical Simulation of Class of Reaction-Diffusion System: Non-linear parabolic systems*<br>• **Abdullahi Yusuf**<br>*Space-time fractional Rosenou-Haynam equation: Lie symmetry analysis, explicit solutions and conservation laws*<br>• **Özlem Orhan**<br>*μ-Symmetry Classification and Reductions of Gardner Equation* | **Session 3**<br><br>**Moderator:**<br>**Gulgassyl Nugmanova**<br><br>• **Candan Çelik**<br>*Markov Chain Modeling of 2D Population Balance Equation*<br>• **Dilek Demirkuş**<br>*Nonlinear SH Waves in a Hyperbolically Varying Heterogeneous Elastic Layer*<br>• **Nurgissa Myrzakulov**<br>*F(T) gravity with fermion field via Noether symmetry* |
| 16:50-17:00 | **Break** | | |

## August 15, 2017 Tuesday

| | Main Hall | Hall 2 | Hall 3 |
|---|---|---|---|
| 09:30-10:30 | **Invited Speaker 4:**<br>**Moderator: Cihan Saçlıoğlu**<br>**Prof. Metin Gürses**<br>Bilkent University, Turkey<br>Title: Nonlocal Reductions of Integrable Equations | | |
| 10:30-11:00 | **Poster Session & Coffee Break** | | |
| 11:00-12:00 | **Invited Speaker 5:**<br>**Moderator: Ersin Özuğurlu**<br>**Prof. Maria Clara Nucci**<br>University of Perugia, Italy<br>Title: Symmetries at work | | |
| 12:00-13:00 | **Lunch** | | |
| 13:00-14:00 | **Invited Speaker 6:**<br>**Moderator: Nihat Berker**<br>**Prof. Victor Kac**<br>Massachusetts Institute of Technology, USA<br>Title: A rigorous theory of integrable systems of PDE | | |
| 14:00-14:30 | **Poster Session & Coffee Break** | | |
| 14:30-15:30 | **Invited Speaker 7:**<br>**Moderator: Teoman Özer**<br>**Prof. Varga Kalantarov**<br>Koc University, Turkey<br>Title: Global Stabilization of Navier-Stokes-Voight Equations and Related Systems by Finite Number of Feedback Controllers | | |
| 15:30-16:50 | **Session 7**<br><br>**Moderator:**<br>**Mohammad M. Akbar**<br><br>• **Ayse Humeyra Bilge**<br>*Integrability of the Essentially Nonlinear Third Order Evolution Equation*<br>• **Cesar Rodrigo**<br>*Reduction of Discrete Lagrangian Gauge Field Theories*<br>• **Zehra Pinar**<br>*The Solutions of the Foam-Drainage Equation via combination of Group Transformations and Auxiliary Equation Method*<br>• **Ana Cristina Casimiro**<br>*Numerical Integrators in reduced coordinates for Lagrangian gauge field theories* | **Session 8**<br><br>**Moderator:**<br>**Jeremy Schiff**<br><br>• **Nihal İnce**<br>*An Application of Generalized Entropy Optimization Methods in the Theory of Stochastic Differantial Equations* | **Session 9**<br><br>**Moderator:**<br>**Baver Okutmustur**<br><br>• **Aizhan Myrzakul**<br>*On the Hojman Symmetry Approach in FRW Cosmology*<br>• **Özcan Sert**<br>*The Non-minimally Coupled Electromagnetic Fields to Gravity and Charged Regular Black Hole Metrics*<br>• **Özcan Sert**<br>*The Electromagnetic Duality Symmetry of the Non-minimally Coupled Electromagnetic Fields to Gravity* |
| 16:50-17:00 | **Break** | | |

## August 15, 2017 Tuesday

| | Main Hall | Hall 2 | Hall 3 |
|---|---|---|---|
| 17:00-18:20 | **Session 10**<br><br>**Moderator:**<br>**Alexei Cheviakov**<br><br>• **Alexandre Vinogradov**<br>*Particle-like structure of Lie algebras*<br>• **Om Kalthoum Wannassi**<br>*Positive solutions for singular nonlinear semipositone fractional differential equations with integral boundary conditions.*<br>• **Jeremy Schiff**<br>*Backlund transformations and infinitesimal symmetries*<br>• **Mehmet Gümüş**<br>*Qualitative Analysis of a Symmetrical System of Rational Difference Equations* | **Session 11**<br><br>**Moderator:**<br>**Dmitry Lyakhov**<br><br>• **Nazife Koca**<br>*Regular and Non-regular Chiral Polyhedra*<br>• **Nadia Idrissi Fatmi**<br>*The global existence in the quadratic case for a model of Nickel-Iron alloy electrodeposition on rotating disk electrode*<br>• **Boussetila Nadjib**<br>*A Modified Quasi-Boundary Value Method for an Abstract Ill-Posed Biparabolic Problem* | **Session 12**<br><br>**Moderator:**<br>**Sergey Zuev**<br><br>• **Baver Okutmustur**<br>*Numerical Analysis of Relativistic Burgers Model on FLRW Spacetime*<br>• **Aliyu Isa Aliyu**<br>*Dynamics of Optical Solitons and Conservation Laws for the Modi fied Nonlinear Shrodinger's equation for Davydov Solitons in alpha-helix proteins*<br>• **Melike Kaplan**<br>*Conservation laws and exact solutions of the Wu-Zhang system* |

# August 17, 2017 Thursday

| | Main Hall | Hall 2 | Hall 3 |
|---|---|---|---|
| 09:30-10:30 | **Invited Speaker 12:**<br>**Moderator: Metin Orhan Kaya**<br>**Prof. Masood Khalique**<br>North-West University, South Africa<br>Title:Symmetry analysis of a coupled (2+1)-dimensional hyperbolic system | | |
| 10:30-11:00 | **Poster Session & Coffee Break** | | |
| 11:00-12:00 | **Invited Speaker 13:**<br>**Moderator: Kamuran Saygılı**<br>**Prof. Kamal Soltanov**<br>Hacettepe University, Turkey<br>Title: Long-time behavior of solutions and chaos in reaction-diffusion equations | | |
| 12:00-13:00 | **Lunch** | | |
| 13:00-14:20 | **Session 16**<br><br>**Moderator:**<br>**Uuganbayar Zunderiya**<br><br>• **Adrian Ruiz**<br>*Construction of solvable structures from $\mathfrak{so}(3,\mathbb{C})$*<br>• **Mehmet Kocabıyık**<br>*Lie Symmetry Analysis of an Epidemic Systems*<br>• **Gulistan Iskandarova**<br>*Group Analysis Method for Space-Time Fractional Nonlinear Generalized Burger's Differential Equation*<br>• **Abderrazek Chaoui**<br>*On the solution of fractional pseudoparabolic equation with fractional integral condition* | **Session 17**<br><br>**Moderator:**<br>**Çağlar Göksu**<br><br>• **Om Kalthoum Wannassi**<br>*Positive solutions for nonlinear semipositone fractional differential equations with integral boundary conditions*<br>• FSOBOF,IBJSFEEJOF<br>*Analytical Solution of Linear Integro-Differential Equations with Weakly Singular Kernel by Using Taylor Expansion Method* | **Session 18**<br><br>**Moderator:**<br>**Gülden Gün Polat**<br><br>• **Zehra Pınar**<br>*Symbolic Solutions of Nonlinear PDEs via WTC Test*<br>• **Ekin Deliktaş**<br>*Nonlinear Modulation of Love Waves on a Slowly Varying Layered Media* |
| 14:20-14:40 | **Closing Session** | | |

## INVITED SPEAKERS

**Prof. Mohammad M. Akbar**
University of Texas at Dallas, USA
Title: Symmetries of the Einstein Equations for Static Axisymmetric and Cylindrical Gravitational Wave Systems in Vacuum and Ricci Solitons
**August 14, 2017 Monday, 14:00-15:00**

**Prof. Alexei Cheviakov**
University of Saskatchewan, Canada
Title: Conservation Laws of Partial Differential Equations: Different Types, Physical Meaning, Systematic Computation, Properties, and Examples
**August 16, 2017 Wednesday, 11:00-12:00**

**Prof. Metin Gürses**
Bilkent University, Turkey
Title: Nonlocal Reductions of Integrable Equations
**August 15, 2017 Tuesday, 09:30-10:30**

**Prof. Victor Kac**
Massachusetts Institute of Technology, USA
Title: A Rigorous Theory Of Integrable Systems Of PDE
**August 15, 2017 Tuesday, 13:00-14:00**

**Prof. Varga Kalantarov**
Koc University, Turkey
Title: Global Stabilization of Navier-Stokes-Voight Equations and Related Systems by Finite Number of Feedback Controllers
**August 15, 2017 Tuesday, 14:30-15:30**

**Prof. Masood Khalique**
North-West University, South Africa
Title: Symmetry Analysis Of A Coupled (2+1)-Dimensional Hyperbolic System
**August 17, 2017 Thursday, 09:30-10:30**

## INVITED SPEAKERS

**Prof. Sergey Meleshko**
Suranaree University of Technology, Thailand
Title: Symmetries of Equations with Nonlocal Terms
**August 14, 2017 Monday, 12:00-13:00**

**Prof. Maria Concepcion Muriel**
University of Cádiz, Spain
Title: Generalized Symmetries and Lambda-Symmetries
**August 16, 2017 Wednesday, 09:30-10:30**

**Prof. Maria Clara Nucci**
University of Perugia, Italy
Title: Symmetries at Work
**August 15, 2017 Tuesday, 11:00-12:00**

**Prof. Peter Olver**
University of Minnesota, USA
Title: Emmy Noether: Symmetry and Conservation
**August 14, 2017 Monday, 10:30-11:30**

**Prof. Greg Reid**
University of Western Ontario, Canada
Title: Approximate Geometry and Symmetry of Partial Differential Equations
**August 16, 2017 Wednesday, 14:30-15:30**

**Prof. Kamal Soltanov**
Hacettepe University, Turkey
Title: Long-Time Behavior of Solutions and Chaos In Reaction-Diffusion Equations
**August 17, 2017 Thursday, 11:00-12:00**

**Prof. Alexandre Vinogradov**
Levi-Civita' Institute, Italy
Title: General Theory of Non-Linear Pdes : The State of The Art and Some Perspectives
**August 16, 2017 Wednesday, 13:00-14:00**

# ABSTRACTS

## August 14, 2017 Monday

**Main Hall 15:30-16:50 Session 1**

**Category**: Super-Symmetry and Super-Integrability
**Keywords:** superintegrability, quantization, Born-Jordan quantization
**Abstract No:** 1072

### SUPERINTEGRABILITY AND QUANTIZATION

*Giovanni Rastelli* [1]
University of Turin Mathematics Turin-Italy [1]

Quantization is the procedure that transforms classical functions of canonical coordinates into quantum observables. Often, the quantization of the Hamilton's function only is considered, but for some systems, integrable or even superintegrable, other constants of motion have to be considered. We review here different quantization procedures for some examples of superintegrable systems of classical mechanics and see how the constraint of preserving their superintegrability can be satisfied or not. The Born-Jordan, Weyl and Laplace-Beltrami quantizations are considered. It is shown in particular that the Born-Jordan quantization, differently from Weyl's one, does not preserve the superintegrability of the 2D anisotropic harmonic oscillator.

**Category**: Super-Symmetry and Super-Integrability
**Keywords:** Hamiltonian systems, quantum symmetries, classical first integrals
**Abstract No:** 1073

### EXTENDED HAMILTONIANS AND SHIFT, LADDER FUNCTIONS AND OPERATORS

*Claudia Maria Chanu* [1], Giovanni Rastelli [1]
University of Torino Mathematics Torino-Italy [1]

In recent years, many natural Hamiltonian systems, classical and quantum, with constants of motion of high degree, or symmetry operators of high order, have been found and studied. Most of these Hamiltonians, in the classical case, can be included in the family of Extended Hamiltonians, geometrically characterized by the structure of Warped Manifold of their configuration manifold. For the extended manifolds, the characteristic constants of motion of high degree are polynomial in the momenta of determined form. We consider here a different form of the constants of motion, based on the factorization procedure developed by S. Kuru, J. Negro and others. We show that a (big) subclass of the extended Hamiltonians admits factorized constants of motion and we determine their expression. These constants may be non-polynomial in the momenta, but the factorization procedure allows, in a type of extended Hamiltonians, their quantization via shift and ladder operators, for systems of any finite dimension and degree.

# ABSTRACTS

## August 14, 2017 Monday

**Main Hall 15:30-16:50 Session 1**

**Category**: Super-Symmetry and Super-Integrability
**Keywords:** elliptic hypergeometric function, basic hypergeometric function, supersymmetric gauge theory, Yang-Baxter equation, Painleve equation
**Abstract No:** 1050

### HYPERGEOMETRIC BETA INTEGRALS: FROM SUPERSYMMETRIC DUALITIES TO THE PAINLEVE EQUATIONS

*Ilmar Gahramanov* [1]
Max Planck Institute for Gravitational Physics Quantum Gravity group Potsdam-Germany [1]

We give a brief survey of the current status of some recently discovered beta integrals of hypergeometric type. They have attracted the attention of physicists since they proved to be useful tool in theoretical and mathematical physics. Such hypergeometric integrals appear in various ways in mathematical physics, in particular, they arise naturally in the computation of the partition functions of supersymmetric gauge theories, in integrable models, in discrete Painleve equations and so on. In the talk we will mainly discuss the elliptic and basic hypergeometric integrals, their properties and relation to different fields of mathematical physics. If time permits we will discuss some open problems.

# ABSTRACTS

## August 14, 2017 Monday

**Hall 2 15:30-16:50 Session 2**

**Category**: Mathematical Physics
**Keywords:** chiral polyhedra, quaternions, octahedral and icosahedral symmetries, dual, Coxeter Weyl groups, pyritohedral symmetry, snub dodecahedron, roots
**Abstract No:** 1062

### REGULAR AND NON-REGULAR CHIRAL POLYHEDRA

*Nazife Koca* [1]
Sultan Qaboos University Physics Muscat-Oman [1]

We construct regular and non-regular chiral polyhedra and their dual solids by using rank-3 Coxeter groups. There are two regular chiral Archimedean polyhedra, the snub cube and snub dodecahedron. We use a method which describes the Coxeter groups and their orbits in terms of quaternions. The snub cube and the snub dodecahedron can be derived from the weight vectors, which are linear combinations of the simple roots by the employing the proper rotation groups of the Coxeter groups W(B3)/C2 and W(H3)/C2 respectively. We also construct the quasi-regular and non-regular chiral polyhedra respecting the chiral tetrahedral, octahedral and icosahedral symmetries. We obtain the pyritohedral group as the group generated by the rotational generators and the Dynkin diagram symmetry of the Weyl group of A3 and discuss the constructions of the pseudo icosahedron and its dual pyritohedron. In the absence of Dynkin diagram symmetry one obtains the tetartoid and its dual, both are useful in crystallography. The pyritohedron consisting of twelve identical quasi-regular pentagonal faces and its dual pseudoicosahedron that possess the pyritohedral (Th) symmetry play an essential role in understanding the crystallographic structures with the pyritohedral symmetry.

*References:*
*1.Mehmet Koca, Nazife Ozdes Koca and Muna Al-Shu'eili, Chiral Polyhedra Derived from Coxeter Diagrams and Quaternions, SQU Journal for Science, 16 (2011) 63-82. 2.Mehmet Koca, Nazife Ozdes Koca, and Ramazan Koç, Catalan Solids Derived From 3D-Root Systems, J. Math. Phys. 51 (4) (2010) 043501 DOI: 10.1063/1.3356985.*
*3.Mehmet Koca, Ramazan Koc and Mudhahir Al-Ajmi, Polyhedra obtained from Coxeter groups and quaternions, J. Math. Phys. 48 (11) (2007) 113514. DOI: 10.1063/1.2809467.*

**Category**: Mathematical Physics
**Keywords:** Poisson--Nernst--Planck equations, electrochemical systems, Butler--Volmer reaction kinetics, classical solution.
**Abstract No:** 1068

### THE GLOBAL EXISTENCE IN THE QUADRATIC CASE FOR A MODEL OF NICKEL-IRON ALLOY ELECTRODEPOSITION ON ROTATING DISK ELECTRODE

*NADIA IDRISSI FATMI* [1]
Laboratory LIPOSI, ENSA KHOURIBGA Computer Mathematics Casablanca-Morocco [1]

To better understand the nickel-iron electrodeposition process, we are interested in the one-dimensional model. This model addresses dissociation, diffusion, electomigration, convection and deposition of multiple ion species. We study the global existence of solutions that are here different ion concentrations in the mixture as well as the electric potential. The classic techniques, based on the Cα estimations, to prove the existence and the positivity of solutions fall in defect and news techniques must be developed. We present them here and we obtain global existence and positivity of classical solution for our model in the quadratic case, without any restriction of growth on the non linear terms.

# ABSTRACTS

## August 14, 2017 Monday

**Hall 2 15:30-16:50 Session 2**

**Category**: Mathematical Physics
**Keywords:** Ill-posed problems; biparabolic problem; Regularization.
**Abstract No:** 1122

### A MODIFIED QUASI-BOUNDARY VALUE METHOD FOR AN ABSTRACT ILL-POSED BIPARABOLIC PROBLEM

*Boussetila Nadjib* [1]
Guelma University Mathematics Guelma-Algeria [1]

In this talk, we are concerned with the problem of approximating a solution of an ill-posed biparabolic problem in the abstract setting. In order to overcome the instability of the original problem, we propose a modified quasi-boundary value method to construct approximate stable solutions for the original ill-posed boundary value problem. Finally, some other convergence results including some explicit convergence rates are also established under a priori bound assumptions on the exact solution. Moreover, numerical tests are presented to illustrate the accuracy and efficiency of this method.

# ABSTRACTS

## August 14, 2017 Monday

**Hall 3 15:30-16:50 Session 3**

**Category**: Engineering and Mechanics
**Keywords:** population balance equation, partial integro differential equations, markov chains, mathematical modeling
**Abstract No:** 1112

### MARKOV CHAIN MODELING OF 2D POPULATION BALANCE EQUATION

*Candan Çelik* [1], Nurşin Baş Çatak [1]
Ege University Mathematics Izmir-Turkey [1]

Multi-dimensional population balance equations (PBEs) display a good realisation for the evolution of particule propety distribution in various branches of applied sciences such as chemical engineering, pharmaceutical industry and aerosoltechnology. The analytical solutions of PBEs are limited only for some specific functions. Therefore, numerical methods are important in order to find an approxiamted solution for PBEs. One of the effective numerical solution of PBEs is the Markov Chain Method. In this work, 2-dimensional particle property-size and energy-distribution is studied to model the breakage equation by using Markov Chains. The simulation results show that the method of Markov Chains provides a good approximation for the particle property distributions.

**Category**: Engineering and Mechanics
**Keywords:** Heterogeneous Layer, Nonlinear SH Waves
**Abstract No:** 1125

### NONLINEAR SH WAVES IN A HYPERBOLICALLY VARYING HETEROGENEOUS ELASTIC LAYER

*Dilek Demirkuş* [1]
I.T.U. Mathematics Engineering Istanbul-Turkey [1]

In this work the spatial and material coordinates of a point referred to the same rectangular Cartesian system of axes are (x1,x2,x3) and (X1,X2,X3), respectively. To consider a layer of uniform thickness h > 0, lying on a rigid semi-infinite substratum. The layer takes place between the planes X2 = 0 and X2 = h, and the half space occupies the region X2 < 0. The layer consists of heterogeneous, isotropic and incompressible hyper-elastic materials. Heterogeneity hyperbolically varies with the depth and it is uniform in any direction parallel to the boundaries. Waves of SH type are only to be considered, and so displacements in the X1- and X2-directions are equal to zero, and also the motion is assumed to be uniform in the X3-direction. The displacement in the X3-direction is zero at the rigid boundary X2 = 0 and it is assumed that the boundary X2 = h is free of traction. In the analysis it is shown that self modulation of nonlinear SH waves is governed by the nonlinear Schrödinger equation by using the method of multiple scales. The aspect of known properties of solutions of nonlinear Schrödinger equation, it is found that the envelope solitary waves and the dark solitary waves can exist depending on the nonlinear constitution of layer. Furthermore, not only the effect of heterogeneity on the deformation field for envelope and dark solitary waves is discussed but also the effect of nonlinearity on the deformation field is discussed.

# ABSTRACTS

## August 14, 2017 Monday

**Hall 3 15:30-16:50 Session 3**

**Category**: Relativity Theory
**Keywords:**
**Abstract No:** 1042

### F(T) GRAVITY WITH FERMION FIELD VIA NOETHER SYMMETRY

*Nurgissa Myrzakulov* [1], Gulnur Tursumbayeva [1], Ratbay Myrzakulov [1]
L.N. Gumilyov Eurasian National University General and Theoretical Physics Astana-Kazakhstan [1]

In this paper, we explore modified gravity so-called F(T) gravity which non-minimally coupled to fermionic field. To obtain gravitational coupling and the self-interaction potential we used Noether symmetry approach. Cosmological solutions of model are analized.

# ABSTRACTS

## August 14, 2017 Monday

**Main Hall 17:00-18:20 Session 4**

**Category**: Differential Geometry
**Abstract No:** 1119

### APPLICATIONS OF SIGNATURE CURVES IN COMPUTER VISION.

*Chehrzad Shakiban* [1]
University of St. Thomas Mathematics St. Paul-United States [1]

In this talk, we focus on the application of an Euclidean invariant curve, called the signature curve, formed by taking curvature and derivative of curvature with respect to arc length of a closed curve, $\Sigma = \{(\kappa(t), \kappa s(t))\}$ to characterize the contour of melanomas and moles and cancer cells. We will then introduce another invariant curve called the space signature curve by bringing torsion $\tau(t)$ into the equation, $\Sigma = \{(\kappa(t),\kappa s(t),\tau(t))\}$ for 3D closed curves and apply it to analyze circular DNA models. Finally, we will introduce the skeletal signature curve which is a new method we are investigating for charactering and identifying surfaces in 3D.

**Category**: Lie Theory and Symmetry Methods in Ordinary Differential Equations
**Keywords:**
**Abstract No:** 1099

### CONSERVATION LAWS, FIRST INTEGRALS AND INTEGRATING FACTORS OF LIÉNARD I-TYPE AND LIÉNARD II-TYPE EQUATIONS

*Gülden GÜN POLAT* [1], Teoman ÖZER [1]
Faculty of Civil Engineering Istanbul Technical University Division of Mechanics Istanbul-Turkey [1]

In this study, first of all, some methods that allow to find the first integrals and integration factors of the differential equations are explained in detail and these methods are applied to Liénard I-type and Liénard II-type equations. The relationship between the methods that are studied here are analyzed then their indirect and direct connections between each other are evaluated. The important relations that are lambda-symmetries with Lie symmetries, Prelle-Singer method with lambda-symmetries and Lie symmetries with Jacobi multipliers are claimed. Noether symmetries, lambda-symmetries via Lie symmetries, integration factors, first integrals and Jacobi multipliers of Liénard I-type and Liénard II-type equations are derived.

# ABSTRACTS

## August 14, 2017 Monday

**Hall 2 17:00-18:20 Session 5**

**Category**: Conservation Laws
**Keywords:** nonlinear self-adjointness, Hirota Tsatsuma Coupled KdV Systems, Lie point symmetries.
**Abstract No:** 1102

### LIE POINT SYMMETRIES, NONLINEAR SELF-ADJOINTNESS AND CONSERVATION LAWS FOR TWO GENERALIZED HIROTA-SATSUMA COUPLED KDV SYSTEMS

Mustafa Inc [1], *Aliyu Isa Aliyu* [1], Abdullahi Yusuf [1], Dumitru Baleanu [2]
Firat University Mathematics Elazig-Turkey [1] Cankaya University, Mathematics Ankara-Turkey [2]

In this article, we aim to study two generalized Hirota Tsatsuma Coupled KdV Systems, both from point of view of Lie point symmetries and nonlinear self-adjointness. Then, the conservation laws are established from the property of nonlinear self-adjointness introduced by Ibragimov.

**Category**: Conservation Laws
**Abstract No:** 1103

### NONLINEAR SELF-ADJOINTNESS AND CONSERVATION LAWS FOR SOME TIME FRACTIONAL NONLINEAR SYSTEMS OF PARTIAL DIFFERENTIAL EQUATIONS

*Abdullahi Yusuf* [1], Mustafa Inc [1], Aliyu Isa Aliyu [1], Dumitru Baleano [2]
Firat University Turkey Mathematics Elazig-Turkey [1] Cankaya University, Mathematics Ankara- [2]

In this work, we make another extension of nonlinear self-adjointness and Noether operators techniques for contructing conserved vectors of some time fractional nonlinear systems of partial differential equations. We use Lie symmetry method to obtain infinitesimal generators for the governing systems. The obtained infinitesimal are used to construct the conservation laws for the corresponding fractional systems.

# ABSTRACTS

**Category**: Conservation Laws
**Keywords:** Partial differential equations; symbolic computation; exact solutions; conservation laws.
**Abstract No:** 1114

## CONSERVATION LAWS AND EXACT SOLUTIONS OF THE FIFTH ORDER (1+1)-DIMENSIONAL KAUP-KUPERSHMIDT EQUATION

*Melike Kaplan* [1], Arzu Akbulut [2], Filiz Tascan [2]
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Partial differential equations, which describe nonlinear phenomena, appear in a wide variety of applications in solitary waves theory, water waves, plasma physics, chemical physics, coastal engineering, hydrodynamics, theory of turbulence, optical fibers, fluid mechanics, chaos theory, ocean engineering, tsunami waves and many other applications. It is significantly important to search for exact solutions to these equations. Exact solutions play a vital role in understanding various qualitative and quantitative features of nonlinear phenomena. Several powerful methods have been proposed to obtain exact solutions of these equations In this study, we dealt with conservation laws and exact travelling wave solutions of the fifth order (1+1)-dimensional Kaup-Kupershmidt equation. We used conservation theorem for finding conservation laws for this equation. All founded conservation laws are trivial conservation laws. Also the obtained exact solutions have not been founded before.

**Category**: Conservation Laws
**Keywords:** Finite volume, Conservation laws, Euler equations, Shock waves
**Abstract No:** 1083

## NUMERICAL SHOCK PROPAGATION IN CURVED CHANNELS

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An accurate and robust numerical scheme for the solution of the compressible Euler equations of gas dynamics is developed and is illustrated by finding the flow of a compressible gas in a variable geometry shock tube. These compressible flow equations are a canonical example of hyperbolic systems of conservation laws and are a standard system in computational fluid dynamics. Hyperbolic systems of conservation laws present numerical challenges due to the formation of features such as shock waves (discontinuities), rarefaction waves and contact discontinuities in the resulting solution (flow) [1]. To capture these features highly accurate numerical schemes capable of fitting discontinuities (shocks) without resultant spurious numerical artifacts are needed.

Such a suitable numerical scheme is described and its stability and accuracy are evaluated using standard numerical tests. To fully demonstrate the effectiveness and accuracy of the numerical scheme, it is used to find the flow of a compressible gas in a shock tube consisting of a 900 circular bend joining two straight segments. This flow configuration was chosen as the numerical solutions can be compared with existing experimental data [2]. The numerical results for flow quantities such as pressure and shock position are found to be in excellent agreement with the experimental results.

Acknowledgement : This work is supported by Ahi Evran University Scientific Research Projects Coordination Unit (Project Number : FEF.A3.16.037).

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# ABSTRACTS

## August 14, 2017 Monday

**Hall 3 17:00-18:20 Session 6**

**Category**: Mathematical Physics
**Keywords:** multy-layer magnetic system, integrable systems, geometrical flows of curves and surfaces
**Abstract No:** 1049

### MOTION OF THREE INTERACTING CURVES, MULTI-LAYER SPIN SYSTEMS AND THE VECTOR NLS-MAXWELL-BLOCH EQUATION

Zhanna Sagidullayeva [1], *Gulgassyl Nugmanova* [2], Ratbay Myrzakulov [1]
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It is well-known that geometrical flows of curves and surfaces induce some class of integrable nonlinear evolution equations. In this paper we show that the motion of three interacting curves and/or equivalently, moving and interacting three surfaces can be associated with an integrable 3-layer spin system with self-consistent potentials. It is shown that this spin system with self-consistent potentials is geometrically equivalent to the three-component nonlinear Schr\"odinger - Maxwell - Bloch equation (NLSMBE). Lax representations of these integrable equations are presented. We also considered the so-called $\Gamma$-spin system with self-consistent potentials which in turn is gauge equivalent to the NLSMBE. The relation between solutions of the 3-layer spin system with self-consistent potentials and the $\Gamma$-spin system with self-consistent potentials is presented.

**Category**: Mathematical Physics
**Keywords:** Fractional Calculus, Variational Calculus
**Abstract No:** 1116

### A FRACTIONAL APPROACH TO THE VARIATIONAL CALCULUS

*Kazım Gökhan Atman* [1], Hüseyin Şirin [2], Abdullah Engin Çalık [2]
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The variational calculus is encountered in many areas of the fundamental and engineering sciences. The variational calculus are usually calculated with standard mathematics in the literature and are applied to the conservative systems. The physical processes which are described close to reality are generally non-conservative processes. It is more accurate to examine nonconservative systems using fractional calculus. In this study, as an example of the non-conservative system, the damped harmonic oscillator has been discussed in terms of fractional variations. The obtained results have been compared with the results of Fractional Action Like Variation Principle (FALVA) and standard mathematics. The standard results have been obtained when the fractional derivative order is equal to one. Furthermore, the results obtained using fractional calculus have been examined for different values of the fractional derivative order.

# ABSTRACTS

## August 14, 2017 Monday

**Main Hall 17:00-18:20 Session 4**

**Category**: Mathematical Physics
**Keywords:** Compact operator, Hausdorff measure of noncompactness, Absolute Nörlund summability.
**Abstract No:** 1120

### COMPACTNESS OF MATRIX OPERATORS ON ABSOLUTE NORLUND SUMMABILITY SPACES

*G. Canan Hazar Güleç* [1], M. Ali Sarıgöl [1]
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In the present study, we characterize some classes of compact operators given by matrices on the absolute Nörlund summability spaces. For this purpose, we obtain some identities for the Hausdorff measure of noncompactness of these operators.

# ABSTRACTS

## August 15, 2017 Tuesday

**Main Hall 15:30-16:50 Session 7**

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Abstract No:** 1135

### INTEGRABILITY OF THE ESSENTIALLY NONLINEAR THIRD ORDER EVOLUTION EQUATION

*Ayse Humeyra Bilge* [1]
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The well known classification of third order evolution equations via formal symmetries gives 3 classes [1] ut =A1u3 + A2, (4.1a) ut =(A1u3 + A2)−2 + A3, (4.1b) ut =(2A1u3 + A2)(A1u2 3 + A2u3 + A3)−1/2 + A4. (4.1c) The first, quasi-linear class is completely classified but the proof of the integrability of last two classes is not complete. In previous work we proved that [2], up derivatives of order 3 the third essentially non-linear class is the starting symmetry of a hierarchy of non-constant separant integrable equations characterized by ρ(−1) = (αu2 3 + βu3 + γ)1/2. In the present work, we complete the proof that the third order essentially nonlinear equation admits a fifth order symmetry, under the assumption β = 0. The second class of third order equations is characterised by ρ(−1) = $\phi$u3 + ψ. We show that this class is a nonconstant separant analogue of the Krichever-Novikov equation, in the sense that these equations can be mapped to each other. This last result is incomplete in the sense that the transformation is obtained at the top order m = 3 only. Keywords. Classification, differential polynomials, evolution equations, hierarchies This is a joint work with Eti Mizrahi

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# ABSTRACTS

## August 15, 2017 Tuesday

**Main Hall 15:30-16:50 Session 7**

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Keywords:** Gauge fields; Discretization; Noether currents; Euler-Poincare equations; variational principles
**Abstract No:** 1013

### REDUCTION OF DISCRETE LAGRANGIAN GAUGE FIELD THEORIES

*Cesar Rodrigo* [1], Ana Cristina Casimiro [2]
Academia Militar DCEN Amadora-Portugal [1] Universidade Nova Mathematics Lisbon-Portugal [2]

Field equations arising in Lagrangian Gauge Field Theories are determined by some minimal action principle on local sections p:X->P of a G-principal bundle P->X. If G acts by symmetries, the local section p is a potential for a more fundamental object, the corresponding field equations can be expressed in terms of reduced fields (sections of J^1P/G). These are geometrically flat principal connections, and field equations can be also obtained from a new minimal action principle on these connections, with flatness as an additional differential constraint. If only a subgroup H acts by symmetries, the corresponding reduced field has two components, namely a H-structure and a connection, both constrained by parallelism relations. Field equations for the reduced fields are called Euler-Poincare equations, for which corresponding conserved currents exist. With the objective of understanding numerical schemes for Euler-Poincare PDEs, in this talk we develop a variational theory for (reduced) discrete gauge fields: considering a G-principal bundle on an abstract simplicial complex as discrete base space and a discrete variational principle with symmetries, we explore both the discrete potential/reduced field situations. This exploration is performed at the levels of first variation and Noether's conserved currents associated to symmetries. Introducing a bi-invariant mean notion on principal bundles , we create discrete Lagrangian gauge field theories related to smooth ones. Functoriality warrants that symmetries belonging to the structural group G or to the gauge group are preserved in this discretisation mechanism, allowing for a comparison of field equations and conserved currents for four situations, the continuous/discrete field and the potential/reduced field cases.

The utility of these techniques for numerical integration of Euler-Poincare equations is described in the companion talk "Numerical Integrators in reduced coordinates for Lagrangian gauge field theories".

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Keywords:** The foam-drainage equation, group transformations, Bernoulli approximation method.
**Abstract No:** 1063

### THE SOLUTIONS OF THE FOAM-DRAINAGE EQUATION VIA COMBINATION OF GROUP TRANSFORMATIONS AND AUXILIARY EQUATION METHOD

*Zehra Pinar* [1]
Namık Kemal University Mathematics Tekirdağ-Turkey [1]

In this paper, appropriate Lie group transformations are considered as an alternative to a travelling wave transformation, in the auxiliary equation method to solve the foam-drainage equation. Moreover, in particular, Bernoulli differential equation has been considered as an auxiliary equation and using the approach presented, the foam-drainage equation with the fractional order nonlinearity has been solved.

# ABSTRACTS

## August 15, 2017 Tuesday

**Main Hall 15:30-16:50 Session 7**

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Keywords:** Discretization; Gauge fields; Variational integrators; Reduction; Euler-Poincare equations; conserved currents
**Abstract No:** 1014

### NUMERICAL INTEGRATORS IN REDUCED COORDINATES FOR LAGRANGIAN GAUGE FIELD THEORIES

*Ana Cristina Casimiro* [1], Cesar Rodrigo [2]
Universidade Nova de Lisboa Mathematics Lisbon-Portugal [1] Academia Militar DCEN Lisbon-Portugal [2]

The principal-bundle structure fixed for gauge field theories is decisive for covariance and energy-conservation properties, which disappear in a discrete setting when applying most common numerical integration schemes for PDEs.

Following the ideas presented in the companion talk "Reduction of Discrete Lagrangian Gauge Field Theories", if we have a minimal action principle on a G-principal bundle, which admits a subgroup H of the structure group as symmetries, there exists an associated variational problem with smooth reduced fields, and also the corresponding discrete versions of both problems. Field equations (discrete Euler-Lagrange or Euler-Poincare equations) that characterize critical sections of the discrete problems have solutions that approximate smooth solutions of the Euler-Lagrange or Euler-Poincare equations associated to the original minimal action principle. Moreover, all relevant geometrical structures are present both for the smooth and the discrete settings, for gauge fields expressed in terms of potentials, or in its reduced version (taking the quotient by some subgroup H, as presented in the mentioned talk), and symmetries of the minimal action principle lead to conserved currents in all the four formulations: continuous/discrete and potential/reduced fields.

Using the framework of a discrete variational problem on a principal bundle, and of its reduction by some subgroup H of the structure group, we explore the regularity of the corresponding discrete Euler-Lagrange equations, or discrete Euler-Poincaré equations. We identify a criterium for these equations to be regular (in the sense of uniqueness of solutions for initial value problems), in terms of a discrete Legendre transformation. For the regular case a variational integrator is then described, which generates the unique discrete reduced field solving the discrete field equations for given initial conditions.

The theory is illustrated with the dynamics of an elastic material, in the presence of an external force field.

# ABSTRACTS

## August 15, 2017 Tuesday

**Hall 2 15:30-16:50 Session 8**

**Category**: Lie Theory and Symmetry Methods in Stochastic Differential Equations
**Keywords:** Generalized Entropy Optimization Distributions, Characterizing moment functions, Stochastic differantial equations,
**Abstract No:** 1084

### AN APPLICATION OF GENERALIZED ENTROPY OPTIMIZATION METHODS IN THE THEORY OF STOCHASTIC DIFFERANTIAL EQUATIONS

Aladdin Shamilov [1], *Nihal İnce* [1]
Anadolu University Statistics Eskisehir-Turkey [1]

In this study by starting statistcal data and chosing corresponding set of characterizing moment functions Generalized Entropy Optimization Distributions (GEOD) are obtained. It is known that all statistical distributions can be obtained as MaxEnt distribution by choosing corresponding moment functions. However, Generalized Entropy Optimization Distributions (GEOD) in the form of MinMaxEnt,MaxMaxEnt distributions which are obtained on basis of Shannon measure and supplementary optimization with respect to characterizing moment functions, more exactly represent the given statistical data. Then, according to given statistical data the stochastic differantial equation model is constructed. It is known that solutions of Fokker-Planck- Kolmogorov (FPK) equations are the probability density functions (PDF) of random variables which are solutions of stochastic differantial equations. GEOD evaluated for statistical data is compared with corresponding solution of FPK in the sense of entropy measures and other measures. In our investigations, two position are considered. Firstly, GEOD is compared with exact solutions of FPK equations if it exists. Secondly, if exact solution of FPK doesn't exist, then by approximative methods mentioned solution is obtained and is compared with GEOD. Finally, acquried results show that the fields of applications of Generalized Entropy Optimization Methods (GEOM) in stochastic differantial equations can be expanded.

# ABSTRACTS

## August 15, 2017 Tuesday

**Hall 3 15:30-16:50 Session 9**

**Category**: Relativity Theory
**Keywords:** Hojman symmetry, cosmology
**Abstract No:** 1045

### ON THE HOJMAN SYMMETRY APPROACH IN FRW COSMOLOGY

*Aizhan Myrzakul* [1], Ratbay Myrzakulov [1]
L.N. Gumilyov Eurasian National University General and Theoretical Physics Astana-Kazakhstan [1]

The accelerated expansion of the universe is one of the prime problems in modern cosmology. To explain this phenomena there exist various cosmological models arising from the standard General Relativity and its different modifications like F(R) gravity, F(T) gravity and etc. Such a large number of cosmological candidates raised the question of choosing among them the most realistic ones. In this sense, symmetry plays an essential role for determining fundamental cosmological models. Regarding this issue, the Hojman symmetry approach can be a useful tool for finding out such models and constructing their some class of exact solutions if appropriate Hojman vectors are identified. Unlike the Noether symmetry, the conservation laws in the Hojman symmetry can be constructed without using Hamiltonian or Lagrangian formalism. In this work we investigate the Hojman symmetry in the Friedmann-Robertson-Walker gravity. Specifically, we use the Hojman symmetry to find the conserved quantities of particular cosmological models with the matter given by the Chaplygin and van der Waals gases, and found the corresponding conserved quantities.

**Category**: Relativity Theory
**Keywords:** Gravitation, Einstein-Maxwell, Non-minimal coupling, Regular Black hole
**Abstract No:** 1066

### THE NON-MINIMALLY COUPLED ELECTROMAGNETIC FIELDS TO GRAVITY AND CHARGED REGULAR BLACK HOLE METRICS

*Özcan SERT* [1]
Pamukkale University Mathematics Denizli-Turkey [1]

Abstract: Singularity in a theory of gravity is a challenging problem. One can avoid from the singularity with a regular black hole solution. We consider the gravitational models which involve the non-minimally coupled electromagnetic and gravitational fields in Y (R)F^2 form[1,2,3]. We give some new regular black hole solutions for both electrically or magnetically charged cases and the corresponding non-minimally coupled Y(R)F^2 gravity model inspired by [4]. We calculate the energy density and pressures of the model which lead to violate only the strong energy condition in the central region of a black hole.

Keywords: Gravitation, Einstein-Maxwell, Non-minimal coupling, Regular Black hole AMS 2010: 83C15, 83C22

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# ABSTRACTS

## August 15, 2017 Tuesday

**Hall 3 15:30-16:50 Session 9**

**Category**: Relativity Theory
**Keywords:** Gravitation, Einstein-Maxwell, Non-minimal coupling, Electromagnetic duality.
**Abstract No:** 1067

### THE ELECTROMAGNETIC DUALITY SYMMETRY OF THE NON-MINIMALLY COUPLED ELECTROMAGNETIC FIELDS TO GRAVITY

*Özcan Sert* [1]
Pamukkale University Mathematics Denizli-Turkey [1]

Abstract: Non-minimally coupled electromagnetic fields to gravity have some interesting solutions and these solutions may be used to understand dark matter, dark energy and the expansion of the universe. After we give some spherically symmetric solutions of the model in the presence of electromagnetic fields, we point out an existence of an electromagnetic duality symmetry of the model.

Keywords: Gravitation, Einstein-Maxwell, Non-minimal coupling, Electromagnetic duality.
AMS 2010: 83C15, 83C22

*References*

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*[2] Dereli, T., Sert, Ö., Non-minimal ln(R)F^2 couplings of electromagnetic fields to gravity: static, spherically symmetric solutions, Eur. Phys. J. C 71, 1589, 2011.*
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# ABSTRACTS

## August 15, 2017 Tuesday

**Main Hall 17:00-18:20 Session 10**

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Abstract No:** 1137

### PARTICLE-LIKE STRUCTURE OF LIE ALGEBRAS

*Alexandre Vinogradov*

According to the modern view, matter is of a compound structure. The constituents, elementary particles, are characterised by their symmetry properties. These properties are formalised in terms of Lie algebras, and one may hypothesise that this compound nature of matter should be somehow mirrored in the structure of the symmetry algebras. This, and other similar considerations, suggests that Lie algebras have, in some sense, a compound structure. We will present some results of our study motivated by this question. Our main result is that the nite-dimensional Lie algebras over R or over an algebraically closed eld of characteristic zero are made from two elementary constituents/\particles", which we call dyons and triadons. Also we shall consider the reduced inverse problem, namely, that of construction and classication of coaxial Lie algebras, the algebras that can be assembled in one step from base dyons and triadons. The base dyons and triadons are Lie algebra structures that have only one nontrivial structure constant in a given basis, while coaxial Lie algebras are linear combinations of mutually compatible base dyons and triadons. We solve the combinatorial problem of classication of clusters, maximal families of mutually compatible basic dyons and triadons, and, as a consequence, get a complete description of coaxial algebras. The remarkable fact is that dyons and triadons in clusters, like atoms in chemical compounds, are self-organised into structural groups, which are surrounded by casings and linked to each other by connectives. We also shall discuss some related problems, generalisations and applications.

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Keywords:** Nonlinear fractional differential equations, positive solution, Green's functions.
**Abstract No:** 1082

### POSITIVE SOLUTIONS FOR SINGULAR NONLINEAR SEMIPOSITONE FRACTIONAL DIFFERENTIAL EQUATIONS WITH INTEGRAL BOUNDARY CONDITIONS.

*Om Kalthoum WANNASSI* [1]
University of Monastir, Faculty of sciences of Monastir, Monastir, Tunisia. mathematics monastir-Tunisia [1]

In this work, we consider the following nonlinear fractional differential equation

*{<K1.1/>*

*<K1.1 ilk="MATRIX" >*
*$D^{\alpha}u(t)+\mu f(t,u(t))=0$ in (0,1),*
*$u(0)=u'(0)=...=u^{(n-2)}(0)=0, u(1)=\lambda\int_0^1 u(s)ds,$*
*</K1.1>*

*depending on the real parameter $\mu>0$, where n N, $n\geq 3, n-1\leq\alpha\leq n$, $0<\lambda<\alpha$. $D^{\alpha}$ denotes the Reimann-Liouville derivative of order $\alpha$, $f:(0,1)\times[0,\infty)\to(-\infty,+\infty)$ is sing-changing continuous function which may be singular at t=0 or/and t=1. We shall derive some intervals of $\mu$ such that for any $\mu$ lying in those intervals the semipositone boundary value problem admits one or multiple positive solutions. Our study relies on Guo--Krasnoselskii fixed point theorem. Some examples are presented to illustrate our results.*

# ABSTRACTS

## August 15, 2017 Tuesday

**Main Hall 17:00-18:20 Session 10**

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Keywords:** Backlund transformation, symmetry, superposition principle
**Abstract No:** 1111

### BACKLUND TRANSFORMATIONS AND INFINITESIMAL SYMMETRIES

*Jeremy Schiff* [1]
Bar-Ilan University Mathematics Ramat Gan-Israel [1]

There is an algorithmic procedure to find the infinitesimal symmetries of a given PDE, but "exponentiating" these to find formulas for finite symmetries is usually not possible. Backlund transformations are a wide class of methods, that exist for many special PDEs, to construct new solutions from old ones; however they typically do not involve continuous deformations and thus it is not immediately clear how to use them to derive standard, infinitesimal, symmetries. We describe the hidden way in which Backlund transformations generate infinitesimal symmetries of equations such as Korteweg-de Vries, Camassa-Holm, Boussinesq and Degasperis-Procesi. Using Backlund transformations gives a quick and simple proof of the existence of an infinite number of commuting infinitesimal local symmetries for these equations, a derivation of the standard recursion formulae with no issues of locality, and some explicit formulas for nonlocal, noncommuting symmetries. The nonlinear superposition principle for Backlund transformations plays a critical role. However, for equations such as Boussinesq and Degasperis-Procesi, which are associated with 3rd order Lax pairs, the relevant superposition principles are new formulae describing the superposition of three Backlund transformations. We explain the Lie theoretic basis for this.

Joint work with Alexander Rasin.

**Category**: Lie Theory and Symmetry Methods in Difference Equations
**Keywords:** Difference equation, boundedness, global asymptotic stability, equilibrium point
**Abstract No:** 1101

### QUALITATIVE ANALYSIS OF A SYMMETRICAL SYSTEM OF RATIONAL DIFFERENCE EQUATIONS

*Mehmet Gümüş* [1]
Bülent Ecevit University Mathematics Zonguldak-Turkey [1]

This aim of this talk is to investigate the global asymptotic stability of the unique positive equilibrium point of the system of two difference equations x_{n+1}=A+(y_{n-m}/y_{n}), y_{n+1}=A+(x_{n-m}/x_{n}), n=0,1,..., m Z, where A (0,∞), x_{-i} and y_{-i} are arbitrary positive numbers for i=0,1,...,m. Also, we present some results about the general behavior of solutions of aforementioned system.

# ABSTRACTS

## August 15, 2017 Tuesday

**Hall 2 17:00-18:20 Session 11**

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Keywords:** Chemical kinetics; Mathematical modeling; Reaction rate; Reaction-diffusion system; Global existence and positivity; Finite element method.
**Abstract No:** 1090

### MODELISATION, MATHEMATICAL ANALYSIS AND NUMERICAL SIMULATION OF CLASS OF REACTION-DIFFUSION SYSTEM: NON-LINEAR PARABOLIC SYSTEMS

*SAIDA BAKHT* [1], NADIA IDRISSI FATMI [1]
ENSA Khouribga LIPOSI casablanca-Morocco [1]

The mathematical modeling of many phenomena (physics, biomedical, engineering, etc.) is expressed by systems or partial differential equations. Chemical kinetics is one of the most important areas in which mathematical modeling are used. Our interest in this work relates to quantitative or formal chemical kinetics. The key quantity is that of the reaction rate. Knowing the nature of the constituents, it is necessary to specify the quantitative influence of all the measurable factors on the reaction rates. We begin this work by modeling the evolution of chemical reactions in the form of a differential system. It is by taking into account the dependence of the concentrations of the space variable that we obtain from the reaction-diffusion systems that we study under the following two conditions: the positivity of the solutions which is preserved over time and the mass or Balance law. We begin by developing several techniques to demonstrate the Global existence, and this with conditions at the edges that are more general. The last part of this work is devoted to the numerical simulation of the reaction-diffusion systems obtained after modeling, by the finite element method. A numerical code has been realized taking into account the various non-linearity.

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Keywords:** RHE, Lie symmetry, RL fractional derivative, Explicit solutions, Cls.
**Abstract No:** 1096

### SPACE-TIME FRACTIONAL ROSENOU-HAYNAM EQUATION: LIE SYMMETRY ANALYSIS, EXPLICIT SOLUTIONS AND CONSERVATION LAWS

*Abdullahi Yusuf* [1], Mustafa Inc [1], Aliyu Isa Aliyu [1], Dumitru Baleano [2]
Firat University Turkey Mathematics Elazig-Turkey [1] Cankaya University, Mathematics Ankara-Turkey [2]

In this paper, we extend the Lie symmetry analysis method to analyze and investigate space-time fractional Rosenou-Haynam equation (RHE) with Riemann-Liouville(RL) derivative. We transform the space-time fractional RHE to nonlinear ordinary differential equation (ODE) of fractional order using its Lie point symmetries with a new dependent variable. In the reduced equation, the derivative is in Erdelyi-Kober (EK) sense. We use power series technique to drive an explicit solutions for the reduced fractional ODE. The convergence of the obtained power series solutions is proved. Moreover, the new conservation theorem and the generalization of the Noether operators are developed to construct the conservation laws (Cls) for the space-time fractional RHE. Some interesting figures for the obtained explicit solutions are presented. The presented Figures show the perspective view, the wave propagation along the x-axis and the overhead view of the obtained explicit solutions using different parameter values.

# ABSTRACTS

## August 15, 2017 Tuesday

**Hall 2 17:00-18:20 Session 11**

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Keywords:** μ-symmetries, μ-prolongation, classification, reduction, invariant solution.
**Abstract No:** 1100

### μ-SYMMETRY CLASSIFICATION AND REDUCTIONS OF GARDNER EQUATION

*Özlem Orhan* [1], Teoman Özer [2]
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In this study, we investigate μ-symmetry properties of the generalized Gardner equation. The classification problem for the Gardner equation is studied based on μ -symmetries and some μ -invariant solutions with respect to different choices of coefficient functions of Gardner equation are obtained and discussed.

**Category**: Lie Theory and Symmetry Methods in Stochastic Differential Equations
**Keywords:**
**Abstract No:** 1127

### INVARIANT APPROACHES FOR THE ANALYTIC SOLUTION OF THE STOCHASTIC BLACK-DERMAN TOY MODEL

*Burhaneddin İzgi* [1], Ahmet Bakkaloğlu [2]
Istanbul Technical University Mathematics Istanbul-Turkey [1] Mimar Sinan Universiity Mathematics Istanbul-Turkey [2]

We work on the analytical solution of the stochastic differential equations (SDEs) via invariant approaches. In particularly, we focus on the stochastic Black-Derman Toy (BDT) interest rate model, among others. After we present corresponding (1+1) parabolic linear partial differential equation (PDE) for BDT-SDE, we use theoretical framework about the invariant approaches for the (1+1) linear PDEs being done in the literature. We show that it is not possible to reduce BDT-PDE into the first and second Lie canonical forms. On the other hand, we success to find transformations for reducing it to the third Lie canonical form. After that, we obtain analytical solution of BDT-PDE by using these transformations. Moreover, we conclude that it can be reduced to the fourth Lie canonical form but, to the best of our knowledge, its analytical solution in this form is hard to find yet.

# ABSTRACTS

## August 15, 2017 Tuesday

**Hall 3 17:00-18:20 Session 12**

**Category**: Conservation Laws
**Abstract No:** 1132

### NUMERICAL ANALYSIS OF RELATIVISTIC BURGERS MODEL ON FLRW SPACETIME

*Baver Okutmustur* [1]
METU Mathematics Ankara-Turkey [1]

A relativistic generalization of Burgers equations was proposed by LeFloch, Makhlof, and Okutmustur and then investigated on Schwarzschild, de Sitter, Schwarzschild--de Sitter and Schwarzschild--Anti--de Sitter spacetimes. In this work, we extend these analysis to a Friedmann--Lemaitre--Robertson--Walker (FLRW) background. This problem is more challenging due to the existence of nontrivial spatially homogeneous solutions. We derive the relativistic Burgers model under consideration and determine its spatially homogeneous solutions. We design a numerical scheme based on a finite volume technique, which is well-preserving in the sense that spatially homogeneous solutions are preserved at the discrete level of approximation. Numerical experiments demonstrate the efficiency of the proposed method for solutions that may contain shock waves.

**Category**: Conservation Laws
**Keywords:** alpha-helix proteins, nonlinear self-adjointness, Conservation laws.
**Abstract No:** 1095

### DYNAMICS OF OPTICAL SOLITONS AND CONSERVATION LAWS FOR THE MODIFIED NONLINEAR SHRODINGER'S EQUATION FOR DAVYDOV SOLITONS IN ALPHA-HELIX PROTEINS

Mustafa Inc [1], *Aliyu Isa Aliyu* [1], Abdullahi Yusif [1], Dumitru Baleanu [2]
Firat University Mathematics Elazig-Turkey [1] Cankaya University Mathematics Ankara-Turkey [2]

This paper employed two integration techniques to obtain soliton solutions of the modified nonlinear Shrödinger's equation for Davydov Solitons in alpha=helix proteins. These are the modified F-Expansion method and the principle of undetermined coeffcients. These yielded dark optical solitons, bright optical soliton, combined optical solitons, periodic singular solitons and singular optical solitons. The constraint conditions that naturally fall out of the solution structure which guarantee the existence of these solitons are also presented. We studied the equation by analyzing a system of partial differential equations (PDEs) obtained by decomposing the alpha-helix protein equation into real and imaginary components. We derive the Lie point symmetry generators of the system and prove that the underlying system is nonlinearly self-adjoint with an explicit form of a differential substitution satisfying the nonlinear self-adjoint condition. Then we use these facts to construct a set of local conservation laws (Cls) for the system using the general Cls theorem presented by Ibragimov. Some interesting gures for the acquired solutions are also presented.

# ABSTRACTS

## August 15, 2017 Tuesday

**Hall 3 17:00-18:20 Session 12**

**Category**: Conservation Laws
**Keywords:** Partial differential equations; symbolic computation; exact solutions; conservation laws.
**Abstract No:** 1115

### CONSERVATION LAWS AND EXACT SOLUTIONS OF THE WU-ZHANG SYSTEM

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Many significant phenomena and dynamic processes in solid state physics, fluid mechanics, chemical physics and plasma waves, such as water surface gravity waves, acoustic waves in unharmonic crystal, electromagnetic radiation reactions, optical fibers, hydro magnetic waves in cold plasma, the heat flow can be represented by nonlinear partial differential equations (PDEs). Some of the most attractive features of the physical systems are covert in their nonlinear treatment. These can just be analyzed by using a proper method which is designed to handle nonlinear problems. In this work, we study one of the most important applications of symmetries to physical problems, namely, the construction of conservation laws. Conservation laws has important place for applications of differential equations and solutions, also in all physics applications. And so, this study deals conservation laws of the Wu-Zhang system. We used Ibragimov's approach for finding conservation laws for given system. The obtained exact solutions have not been founded before.

## ABSTRACTS

# August 16, 2017 Wednesday

**Main Hall 15:40-17:20 Session 13**

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Keywords:** Equivalence Groups, Differential Invariants, Diffusion Equation
**Abstract No:** 1117

### EQUIVALENCE GROUPS AND DIFFERENTIAL INVARIANTS OF A GENERAL 2 DIMENSIONAL DIFFUSION EQUATION

*Saadet Özer* [1]
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Differential equations containing some arbitrary functions or parameters represent, actually family of equations of the same structure. Almost all field equations of classical continuum physics possess this property related to the behavior of different materials. Transformations from the associated equivalence groups of such family of equations have significant importance, as they generate maps between the different members of the same family of equations. Because of this property, we can determine solutions or at least have idea about the behavior of the more complicated problems form an easier one. In this work, the most general family of (2+1) dimensional diffusion equation is considered within the framework of equivalence group. Generators for the transformation group is obtained and their explicit solutions are determined. For various subclasses of the family, the change in the group generators, thereby the form of admissible maps between the members of the family are investigated. We have examined the zeroth and first order differential invariants related to the admitting some special subgroups of equivalence transformations are obtained and their results are discussed. Even though, the equivalence groups of different members of diffusion equation and their differential invariants are studied by some researchers before, there are very few interest in (2+1) dimensional case. And such general class has not been considered in the literature before. The structure of the equivalence groups of smaller classes of the general family can also be obtained by some restrictions on the group generators we have obtained here.

## ABSTRACTS

# August 16, 2017 Wednesday

**Main Hall 15:40-17:20 Session 13**

**Category**: Lie Theory and Symmetry Methods in Integro-Differential Equations
**Keywords:** Fractional differential system; Lie symmetry; Optimal system; Invariant solutions
**Abstract No:** 1074

### ON INVARIANT SOLUTIONS OF A CLASS OF VARIABLE COEFFICIENT TIME FRACTIONAL EVOLUTION SYSTEMS

*Khongorzul Dorjgotov* [1], Hiroyuki Ochiai [2], Uuganbayar Zunderiya [2]
Kyushu University Graduate school of Mathematics Fukuoka-Japan [1] Kyushu University Institute of Mathematics for Industry Fukuoka-Japan [2]

In [1] the following class of time fractional linear evolution system was studied using Lie group theory
\begin{equation}\label{1}
\begin{cases}
\frac{\partial^\alpha u}{\partial t^\alpha}=c^2(x)v_x,\\
\frac{\partial^\alpha v}{\partial t^\alpha}=u_x,
\end{cases}
\end{equation}
where $c(x)$ is a sufficiently differentiable arbitrary function and the fractional derivative is defined as Riemann-Liouville one.
The system (1) is related to following two important sequential equations
\begin{equation}\label{2}
\frac{\partial^\alpha}{\partial t^\alpha}\frac{\partial^\alpha}{\partial t^\alpha}u=c^2(x)u_{x x}
\end{equation}
and
\begin{equation}\label{3}
\frac{\partial^\alpha}{\partial t^\alpha}\frac{\partial^\alpha}{\partial t^\alpha}v=(c^2(x)v_{x})_x.
\end{equation}
The equations (\ref{2}), (\ref{3}) correspond to diffusion and wave equations for the cases of $\alpha=\frac{1}{2}$ and $\alpha=1$ respectively.

The admitted symmetries of the class of system (\ref{1}) are determined and all reduced fractional systems of ordinary differential equations, even some explicit exact solutions for some particular cases are presented in [1]. In this talk, we also study the system (\ref{1}) using the same method as of [1]. But for the case of $c(x)\equiv const,$ we give an additional infinitesimal symmetry, which was not obtained in [1]. With an extra symmetry, which increases the dimensions of Lie algebras generated by infinitesimal symmetries, there arises a question of finding an optimal system of the Lie algebras. So we investigate the structure of Lie algebras of infinitesimal symmetries and determine the optimal system. According to Lie group analysis, the complete group classification of the system (\ref{1}) depending on the function $c(x)$ is obtained. We provide new invariant solutions to the system (1) corresponding to the each symmetries of optimal system explicitly by using special functions. The importance of finding the group invariant solutions of system (1) lies in fact that if $(u(x,t), v(x,t))$ solves the system (1), then $u(x,t)$ solves (2) and $v(x,t)$ solves (3). \\
\textbf{Reference}
\begin{enumerate}
\item Q. Huang, S. Shen “Lie symmetries and group classification of a class of time fractional evolution systems”, J. Math. Phys., 56, No. 12, 11 pp (2015)
\end{enumerate}

# ABSTRACTS

## August 16, 2017 Wednesday

**Main Hall 15:40-17:20 Session 13**

**Category**: Lie Theory and Symmetry Methods in Integro-Differential Equations
**Keywords:** Fractional nonlinear system; Lie symmetry; Optimal system; Invariant solution
**Abstract No:** 1075

### LIE SYMMETRY ANALYSIS OF A CLASS OF TIME FRACTIONAL NONLINEAR EVOLUTION SYSTEMS

Khongorzul Dorjgotov [1], Hiroyuki Ochiai [2], *Uuganbayar Zunderiya* [2]
Kyushu University Graduate school of Mathematics Fukuoka-Japan [1] Kyushu University Institute of Mathematics for Industry Fukuoka-Japan [2]

We study the following class of nonlinear evolution systems of time fractional partial differential equations depending on an arbitrary function using Lie symmetry analysis.
\begin{equation}\label{1}
\begin{cases}
\frac{\partial^\alpha u}{\partial t^\alpha}=v_x,\\
\frac{\partial^\alpha v}{\partial t^\alpha}=b^2(u) u_x,
\end{cases}
\end{equation}
Here $b(u)$ is a sufficiently differentiable non-constant function, $\alpha$ is a positive non-integer number and the fractional derivative is defined as Riemann-Liouville one.

In [1] a nonlinear model of stationary transonic plane-parallel gas flows
\begin{equation}\label{qqqq2}
\begin{cases}
\frac{\partial^\alpha u}{\partial t^\alpha}=v_x,\\
\frac{\partial^\alpha v}{\partial t^\alpha}=-u u_x,
\end{cases}
\mbox{ where } 0<\alpha < 1,
\end{equation}
was studied using the Lie symmetry analysis. The Lie symmetries, some reduced systems of ODEs and some partial solutions of the system (\ref{qqqq2}) was obtained in [1]. By an appropriate substitution the system (1) can be viewed as a generalization of system (2).

We study the system (\ref{1}) by the Lie symmetry analysis. More explicitly, we give a complete group classification depending on the function $b(u)$ and describe a structure of Lie algebras generated by infinitesimal symmetries of the system (\ref{1}). The class of systems is divided into two cases depending on the function $b(u)$. For each case of the system, the dimensions of Lie algebras generated by infinitesimal symmetries are greater than two, so we calculate one-dimensional optimal systems of the Lie algebras. The reduced systems are also obtained corresponding to the optimal systems. Using the optimal systems, we also classify group invariant solutions corresponding to the infinitesimal symmetries for $0<\alpha<1$. Moreover we give some explicit invariant solutions to system (1).\\
\textbf{References:}
\begin{enumerate}
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\end{enumerate}

# ABSTRACTS

## August 16, 2017 Wednesday

**Main Hall 15:40-17:20 Session 13**

**Category**: Lie Theory and Symmetry Methods in Ordinary Differential Equations
**Keywords:** Algorithmic linearization test, differential Thomas decomposition, Lie symmetry algebra
**Abstract No:** 1088

### ALGORITHMIC LINEARIZATION PROCEDURE FOR ORDINARY DIFFERENTIAL EQUATIONS

*Dmitry Lyakhov* [1], Vladimir Gerdt [2], Dominik Michels [1]
KAUST CEMSE Thuwal-Saudi Arabia [1] JINR LIT Dubna-Russia [2]

Solving nonlinear ordinary differential equations (ODEs) is one of the classical and practically important research areas in applied mathematics. In practice, such equations are mostly solved numerically or by approximate analytical methods since obtaining their explicit solution is usually very difficult or even impossible. One of the important approaches for solving a nonlinear ODE explicitly considers the existence of an invertible linearizing transformation of the variables and its construction. The reduction of a nonlinear ODE to a linear one makes its explicit integration much easier and often allows for obtaining an exact solution. We devise two algorithms to check if the equation can be reduced to a linear one by a point transformation. The first algorithm is based on a construction of the Lie point symmetry algebra and on the computation of its derived algebra. The second algorithm exploits the differential Thomas decomposition and allows not only to test the linearizability, but also to generate a system of nonlinear partial differential equations that determines the point transformation and the coefficients of the linear equation. The implementation of both algorithms is discussed and their application is illustrated using several examples.

## August 16, 2017 Wednesday

**Hall 2 15:40-17:20 Session 14**

**Category**: Mathematical Physics
**Keywords:** Conformable fractional Modified Zahharov-Kuznetsov Equation, exact solution, traveling wave
**Abstract No:** 1069

### TRAVELINGWAVE SOLUTIONS TO THE CONFORMABLE FRACTIONAL MODIFIED ZAKHAROV-KUZNETSOV EQUATION VIA SIMPLE ANSATZ

Alper Korkmaz [1], *Ozlem Ersoy Hepson* [2]
Çankırı Karatekin University Mathematics Çankırı-Turkey [1] Eskişehir Osmangazi UNiversity Mathematics & Computer Eskişehir-Turkey [2]

The three dimensional conformable time fractional modified Zakharov- Kuznetsov Equation (fmZKE) is solved exactly by implementing the hyperbolic tangent ansatz. This new definition of the fractional derivative supports sufficient conditions and properties to reduce the fractional PDEs to ODEs in the positive half space. Using these properties, the fmZKE is reduced to an ODE and, then, the ansatz approximation is substituted into the resultant equation. The procedure starts by determining the power of the hyperbolic tangent function and keeps determining the relations among the other parameters. Returning the original variables gives the exact solution. In the study, two exact solutions are constructed explicitly.

# ABSTRACTS

## August 16, 2017 Wednesday

**Hall 2 15:40-17:20 Session 14**

**Category**: Mathematical Physics
**Keywords:** Myrzakulov-I, two-component NLSE, line and curved solitons, breaking solitons, induced dromions
**Abstract No:** 1040

### INTEGRABLE DYNAMICS OF TWO INTERACTING CURVES, THE 2-LAYER MYRZAKULOV-I EQUATION AND THE TWO-COMPONENT ZAKHAROV-STRACHAN EQUATION

*Guldana Bekova* [1], Zhaidary Myrzakulova [2], Ratbay Myrzakulov [1]
Eurasian National University Department of General and Theoretical Physics Astana-Kazakhstan [1] Eurasian National University Department of Higher Mathematics Astana-Kazakhstan [2]

Using a moving space curve formalism, geometrical equivalence between the 2-layer Myrzakulov-I equation (M-I equation) and the (2+1)- dimensional two-component nonlinear Schr\"odinger equation (NLSE) originally discovered by Calogero, discussed then by Zakharov and recently rederived by Strachan, have been estabilished. A compatible set of linear equations (Lax represenation) is obtained and integrals of motion are discussed. Through stereographic projection, the 2-layer M-I equation has been bilinearized. Different types of solutions such as line and curved solitons, breaking solitons, induced dromions, and domain wall type solutions are presented. Breaking soliton solutions of the (2+1)-dimensional two-component NLSE have also been obtained. Some integrable generalizations of the 2-layer M-I equation are discussed.

**Category**: Optimal Control
**Keywords:** ramp metering,feedback linearization,ODE
**Abstract No:** 1091

### A NOUVELLE FEEDBACK CONTROL DESIGN USING THE ODE MODEL OF RAMP METERING PROBLEM

*Gokhan Goksu* [1], Mehmet Ali Silgu [2], Hilmi Berk Celikoglu [2]
Istanbul Technical University Mathematical Engineering Istanbul-Turkey [1] Istanbul Technical University Civil Engineering Istanbul-Turkey [2]

In this study, an isolated ramp metering problem is considered. For this purpose, the Ordinary Differential Equation (ODE) Model with error and queue length state variables of the ramp system is explained. Since this system has nonlinear terms, a feedback linearization is applied. On the other hand, the closed-loop system is found stable when the proposed state feedback gains are applied. Finally, some numerical examples are given and simulation results are presented in order to test the effectiveness and validity of the proposed solutions and compare with the methods in the literature.

**Keywords:** Relativistic Burgers equation, static solutions, spacetime, Reisnerr-Nordström metric, nite volume method, Godunov scheme.

### PROPAGATION OF SHOCK AND RAREFACTION WAVES FOR THE RELATIVISTIC BURGERS MODELS ON REISNERR-NORDSTROM SPACETIME

*Baver Okutmustur*
Middle East Technical University, Ankara, Turkey

We derive the relativistic Burgers equation on a 1+1-dimensional Reissner- Nordström spacetime and introduce a nite volume scheme for the approximation of discontinuous solutions to the model of interest. Our scheme applies to weak solutions containing shock waves and it is well balanced in the sense that it preserves static solutions. The eciency of the method for solutions containing shock and rarefaction waves are presented by numerical experiments.

# ABSTRACTS

## August 16, 2017 Wednesday

**Hall 3 15:40-17:20 Session 15**

**Category**: Dynamical Systems
**Keywords:** Cohen-Grossberg ; neural network systems; equilibrium point; Halanay inequality; exponential stability.
**Abstract No:** 1020

### EXPONENTIAL STABILITY OF SOME NEURAL NETWORK SYSTEMS OF COHEN-GROSSBERG TYPE

*Said MAZOUZI* [1], Nassereddine TATAR [2]
Badji Mokhtar-Annaba University, Department of Mathematics, Annaba,-Algeria [1] King Fahd University of Petrorium and Minerals, Department of Mathematics, Dahran,-Saudi Arabia [2]

Our main concern in the expected oral talk is the study of some neural network systems of Cohen-Grossberg type which are extensively applied in various areas of science and technology such as in neurobiology, image processing and so one. Time delays are introduced in the system because of the finite switching speed of the signal transmission and amplification time. To the knowledge of the reader time delays could cause instability and even oscillation of a given model, and so appropriate assumptions are really needed to avoid chaos, divergence or bifurcation states. We will first establish the existence of a unique equilibrium point for such a system, and then, by using Halanay inequality, we prove that the obtained unique equilibrium is exponentially asymptotically stable.

**Category**: Dynamical Systems
**Keywords:** Nonlinear dynamical system, chaos
**Abstract No:** 1056

### PROBABILITY BASED SIMULATION OF THE NONLINEAR DYNAMICAL SYSTEM

*Sergey Zuev* [1]
Belgorod State Technological University Dept. of the Computer Software & Automated Systems Belgorod-Russia [1]

An arbitrary dynamical system is considered and its evolution is described using terms of probability for the system to be in the certain state at the certain time. The mathematical basis is developed in terms of the Kolmogorov's axioms and the corresponding algorithm is presented together with computer application for one and two dimensional dynamical systems. The theory in developed for any dimensions. The samples of the non-linear and chaotic systems are presented in the talk as figures and animations.

# ABSTRACTS

## August 16, 2017 Wednesday

**Hall 3 15:40-17:20 Session 15**

**Category**: Dynamical Systems
**Keywords:** Caputo derivative, positivity principle, lower and upper solution, existence and uniqueness, eigensolution
**Abstract No:** 1094

### ON THE APPLICATION OF A NEW POSITIVITY PRINCIPLE TO A FRACTIONAL BOUNDARY VALUE PROBLEM

*Said MAZOUZI* [1], Noureddine FERFAR [1]
Badji Mokhtar-Annaba Mathematics Annaba-Algeria [1]

We intend to apply a new positivity principle to some Fractional Boundary Value Problem (FBVP) of order between 0 and 2. Then, we derive necessary and sufficient conditions to obtain an eigensolution to some given nonhomogeneous BVP. Finally, we construct a sequence of lower and upper solutions that converges to the unique solution of our problem.

**Category**: Dynamical Systems
**Keywords:** Domain decomposition methods, overlapping subdomains, Robin boundary conditions, energy methods, finite element methods, relaxation procedure.
**Abstract No:** 1093

### OPTIMAL CONVERGENCE RATE FOR OVERLAPPING DOMAIN DECOMPOSITION METHODS FOR SECOND ORDER BOUNDARY VALUE PROBLEMS

Hanène BOUSSAHA [1], *Ahmed-Salah CHIBI* [2]
Badji Mokhtar-Annaba University Mathematics Annaba-Algeria [1] Annaba University Mathematics Annaba-Algeria [2]

Domain decomposition methods (DDM) have been intensively used as important tools for solving boundary value problems. There are two ways of decomposing a domain: with and without overlapping of subdomains. This work is concerned with the analysis of an overlapping (Schwarz) DDM, using Robin boundary conditions on the interfaces as transition conditions. The nonoverlapping continuous case was studied previously by Lions P. L (1990) and Deng Q. (1997) in the continuous case and by Qin et al. (2006, 2008) in the discrete case. We are interested in the study of the convergence of the iterative process in the continuous case and getting a convergence rate in the discrete case. We use an energy method of Lions to prove the convergence of the iterative process in the continuous case. and a generalization of a relaxation procedure first used by Deng (1997), A relaxation procedure is used, in the discrete case, to avoid the computation of normal derivatives and to facilitate the application of this method to discrete boundary value problems and to get an optimal convergence rate.

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# ABSTRACTS

## August 16, 2017 Wednesday

### Hall 3 15:40-17:20 Session 15

**Category**: Dynamical Systems
**Keywords:** Fractional differential equations, positive solutions, upper and lower solutions, existence, uniqueness, fixed point theorems
**Abstract No:** 1123

### POSITIVE SOLUTIONS FOR NONLINEAR FRACTIONAL DIFFERENTIAL EQUATIONS

*Boulares Hamid* [1]
Guelma University Mathematics Guelma-Algeria [1]

**Abstract:** We study the existence and uniqueness of positive solutions of the nonlinear fractional differential equation

$$\begin{cases} {}^{C}D^{\alpha}x(t) = f(t,x(t)) + {}^{C}D^{\alpha-1}g(t,x(t)), \ 0 < t \leq T, \\ x(0) = \theta_1 > 0, \ x'(0) = \theta_2 > 0, \end{cases}$$

where $1 < \alpha \leq 2$. In the process we convert the given fractional differential equation into an equivalent integral equation. Then we construct appropriate mapping and employ Schauder fixed point theorem and the method of upper and lower solutions to show the existence of a positive solution of this equation. We also use the Banach fixed point theorem to show the existence of a unique positive solution. The results obtained here extend the work of Matar [7]. Finally, an example is given to illustrate our results.

**Keywords:** Key word: Fractional differential equations, positive solutions, upper and lower solutions, existence, uniqueness, fixed point theorems.

**MSC2010:** Primary 26A33, Secondary 34A12, 34G20.

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# ABSTRACTS

## August 17, 2017 Thursday

**Main Hall 14:00-15:20 Session 16**

**Category**: Lie Theory and Symmetry Methods in Ordinary Differential Equations
**Keywords:** Solvable structure, nonsolvable algebra, first integral, parametric solution
**Abstract No:** 1079

### CONSTRUCTION OF SOLVABLE STRUCTURES FROM $\MATHFRAK{SO}(3,\MATHBB{C})$

*Adrian Ruiz* [1], Concepcion Muriel [1]
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It is known that an nth-order ordinary differential equation can be locally integrated by quadratures if and only if the equation admits a solvable structure. However, the explicit computation of a solvable structure may be a difficult task in practice, therefore it is important to develop techniques that allow its construction. One of the possible approach is to exploit the Lie symmetry algebra admitted by the equation.

In this work we focus on third-order ordinary differential equations admitting a Lie symmetry algebra isomorphic to $\mathfrak{so}(3,\mathbb{C})$, which is nonsolvable. For this type of equations it is proved the existence of a solvable structure constructed out the symmetry generators of the algebra. Besides, a procedure to explicitly obtain the solvable structure in terms of solutions to an associated linear second-order equation is also presented.

Once the solvable structure is known, a complete set of first integrals can be computed by quadratures. We also prove that a genereal parametric solution expressed in terms of solutions to an associated linear second-order equation can be obtained from the corresponding implicit solution.

**Category**: Lie Theory and Symmetry Methods in Fractal Differential Equations
**Keywords:** Lie symmetries, Logistic differantial equation, Hanta epidemics,Fractional order differantial equations.
**Abstract No:** 1027

### LIE SYMMETRY ANALYSIS OF AN EPIDEMIC SYSTEMS

*Mehmet KOCABIYIK* [1], Mevlüde YAKIT ONGUN [1]
Suleyman Demirel University mathematics ısparta-Turkey [1]

In this paper, we deal with both the ordinary order and the fractional order of Hanta epidemic models. Second model derived from Abramson-Kenkre model. In this model, the fractional derivatives are used to describe nonhomogeneous character of the ecosystems with the respect to the presence of competitors. Lie symmetry analysis is implemented to find analytic solutions of both of them. The basic point of view for both situations will be Logistic differantial equation which obtained by total populations.

Mehmet KOCABIYIK supported by Scientific and Technological Research Council of Turkey (TUBiTAK 2228-A programme).

# ABSTRACTS

## August 17, 2017 Thursday

**Main Hall 14:00-15:20 Session 16**

**Category**: Lie Theory and Symmetry Methods in Fractal Differential Equations
**Keywords:** Lie groups method, symmetries, Riemann-Liouville fractional derivative, generalized Burger's equation.
**Abstract No:** 1118

### GROUP ANALYSIS METHOD FOR SPACE-TIME FRACTIONAL NONLINEAR GENERALIZED BURGER'S DIFFERENTIAL EQUATION

Dogan Kaya [1], *Gulistan Iskandarova* [1]
of Science and Technology Mathematics Istanbul-Turkey [1]

It is known that nearly all physical phenomena in nature can be described or modeled using a differential equation or a system of differential equations, an integral equation or an integro-differential equation. Moreover, the differential equations, depending on the particular problem can be ordinary or partial, linear or nonlinear. So, we restrict our attention in research a solution of fractional nonlinear generalized Burger's differential equation [1]. And to find some exact solutions of nonlinear generalized Burger's differential equation with fractional derivative in this work we used the method of we introduce Lies groups method [2-7]. After applying the Lie groups we get ordinary differential equations and fractional ordinary differential equations, for which we find the exact solution by using an expansion methods.

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**Category**: Lie Theory and Symmetry Methods in Fractal Differential Equations
**Keywords:** Rothe method, pseudoparabolic equation, a priori estimate
**Abstract No:** 1124

### ON THE SOLUTION OF FRACTIONAL PSEUDOPARABOLIC EQUATION WITH FRACTIONAL INTEGRAL CONDITION

*Abderrazek CHAOUI* [1]
University of Guelma Mathematics Guelma-Algeria [1]

In this talk we are concerned with the application of Rothe method to find approximate solution of pseudoparabolic fractional equation with fractional integral condition.

# ABSTRACTS

## August 17, 2017 Thursday

**Hall 2 14:00-15:20 Session 17**

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Keywords:** Nonlinear fractional differential equations, positive solution, Green's functions.
**Abstract No:** 1085

### POSITIVE SOLUTIONS FOR NONLINEAR SEMIPOSITONE FRACTIONAL DIFFERENTIAL EQUATIONS WITH INTEGRAL BOUNDARY CONDITIONS.

*Om kalthoum WANNASSI* [1]
University of Monastir, Faculty of sciences of Monastir, Monastir, Tunisia. mathematics monastir-Tunisia mathematics Monastir-Tunisia [1]

In this work, we consider the following nonlinear fractional differential equation

$$\begin{cases} D^{\alpha}u(t)+\mu f(t,u(t))=0 \text{ in } (0,1), \\ u(0)=u'(0)=\ldots=u^{(n-2)}(0)=0, u(1)=\lambda\int_0^1 u(s)ds, \end{cases}$$

depending on the real parameter $\mu>0$, where $n\in\mathbb{N}$, $n\geq 3$, $n-1\leq\alpha\leq n$, $0<\lambda<\alpha$. $D^{\alpha}$ denotes the Reimann-Liouville derivative of order $\alpha$, $f:(0,1)\times[0,\infty)\longrightarrow(-\infty,+\infty)$ is sing-changing continuous function which may be singular at t=0 or/and t=1. We shall derive some intervals of $\mu$ such that for any $\mu$ lying in those intervals the semipositone boundary value problem admits one or multiple positive solutions. Our study relies on Guo--Krasnoselskii fixed point theorem. Some examples are presented to illustrate our results.

# ABSTRACTS

## August 17, 2017 Thursday

**Hall 3 14:00-15:20 Session 18**

**Category**: Mathematical Physics
**Keywords:** WTC test, KdV equations, exact solutions
**Abstract No:** 1032

### SYMBOLIC SOLUTIONS OF NONLINEAR PDES VIA WTC TEST

*Zehra Pınar* [1]
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In recent years, the exact solutions are in the interest of many branches, because of inhomogeneity, nonlinearities and some general boundary conditions of nonlinear partial differential equations. There are important tools in identifying nonlinear PDEs which are linearizable by the method of the inverse-scattering-transform. In this paper we give an exact solution of nonlinear partial differential equations using one of these tests.

**Category**: Engineering and Mechanics
**Keywords:** Love waves, Nonlinear Schrodinger Equation
**Abstract No:** 1034

### NONLINEAR MODULATION OF LOVE WAVES ON A SLOWLY VARYING LAYERED MEDIA

*Ekin Deliktaş* [1], Mevlüt Teymür [1]
Faculty of Sciences and Letters Department of Mathematics İstanbul-Turkey [1]

In this study, nonlinear modulation of Love waves propagating on a nonlinear elastic half space covered by a nonlinear elastic layer with a slowly varying thickness is examined. The constituent materials are assumed to be homogenous, isotropic, nonlinear, elastic and having different mechanical properties. It is assumed that the amplitude of the irregularity of boundary surfaces is small compared to the average thickness of the layer. By employing the method of multiple scales, a nonlinear Schrodinger equation (NLS) with variable coefficients is derived for the nonlinear self-modulation of Love waves. We examine the effects of irregularities of the free surface and interface on the propagation characteristics of Love waves.

**Keywords:** General Abel Integral, Integro-dierential Equations,Weakly singular Fredholm integral-equations, Weakly singular Volterra integral-equations.

### ANALYTICAL SOLUTION OF LINEAR INTEGRO-DIFFERENTIAL EQUATIONS WITH WEAKLY SINGULAR KERNEL BY USING TAYLOR EXPANSION METHOD

*Fernane Khaireddine*
University of 8 May 1945 Guelma Algeria

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

## POSTER PRESENTATIONS

| | | |
|---|---|---|
| **August 15, 2017 Tuesday** | **10:30-11:00** | **14:00-14:30** |
| **August 16, 2017 Wednesday** | **10:30-11:00** | **14:00-14:30** |
| **August 17, 2017 Thursday** | **10:30-11:00** | |

**Category**: Conservation Laws
**Keywords:** wave, symmetry, super-structure, zero rest mass, Field theory.
**Abstract No:** 1002

### THE COMPLEX FRACTAL SYMMETRY IN QUANTUM SYSTEM OF CORPUSCLE AND WAVE AS THE CAUSE OF CONSERVATION OF CHARGE IN FIELD SPACE

*Lyubov Nechaj* [1]
O. Ya. Usikov Institute for Radiophysics and Electronics National Academy of Science of Ukraine New physical effects Luhansk-Ukraine [1]

Searching of important technology, for example, antennas and resonator design requires knowledge of the fine wave structure of the Field. Known the use of fractal geometry in the antenna design. Fractal symmetry is a kind of natural symmetry, which, along with other types of symmetry, spontaneously realized in the Field space. We can't capture a Field in the form of a set of points in Euclidean space, Field has the property of self-similarity, it is a physical object that matches any part of itself. Field is a universal essence, the scientific basis of Field space the first formulated by Isaac Newton. The Newton algorithm (known as method of tangents) is a contractive mapping, which requires to the physical behavior of the Field in space and time. The gradients of all order represent the Field function of a complex variable. The presence of natural fractal symmetry in Field space is a recording of the behavior of the Field gradients, generating law of conservation of charge at any point in space. In Standard model the electromagnetic field "shows up" in some field with the additional requirement of local gauge invariance... Electromagnetic waves and the direction of action of electric and magnetic fields exist; however, it is not clear, why in general the wave propagates. Field can be represented as Dynamic chaos, defined by deterministic laws, which are linked to the existence of infinite sets of symmetry and superstructures in Field. The formation of a superstructure is the main factor affecting the properties of the objects - particles or waves, their symmetry is reflected in conservation laws. Ordering process and progress of the ordering progress sometimes can or cannot be measured and studied by different methods, specialists only use Noether's theorem and conservation laws, not looking at the root causes of

## POSTER PRESENTATIONS

**Category**: Dynamical Systems
**Keywords:** Pencil of Operators ;Spectral Theory ;Stability;Implicit differential equations.
**Abstract No:** 1008

### THE STABILITY OF SOME STATIONARY IMPLICIT DIFFERENTIAL EQUATIONS

*Mohamed Harıri* [1]
Djillali Liabes University Mathematics Sidi Bel-Abbes-Algeria [1]

The aim of this research is to study the stability of the stationary implicit differential equation of the form :
\begin{eqnarray}
A x'(t)+Bx(t)=0 &\,\,\,,,\,\,\,\,t\geq 0;
\end{eqnarray}
where A and B are bounded operators in Hilbert spaces. We generalize the Liapounov theorem for the spectrum of the corresponding pencil of operators
$\lambda A+B$. Then we applied the obtained results to establish some stability conditions for the implicit differential equation above.

**Category**: Dynamical Systems
**Keywords:** Pencil of Operators ;Spectral Theory ;Stability;Implicit differential equations.
**Abstract No:** 1015

### THE STABILITY OF SOME STATIONARY IMPLICIT DIFFERENTIAL EQUATIONS

*Mohamed Harıri* [1]
Djillali Liabes University Mathematics Sidi Bel-Abbes-Algeria [1]

The aim of this research is to study the stability of the stationary implicit differential equation of the form :
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where A and B are bounded operators in Hilbert spaces. We generalize the Liapounov theorem for the spectrum of the corresponding pencil of operators
$\lambda A+B$. Then we applied the obtained results to establish some stability conditions for the implicit differential equation above.

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Keywords:** Critical Sobolev exponents Palais-Smale condition Concentration compactness principle Neumann problem
**Abstract No:** 1030

### ON THE NEUMANN PROBLEM FOR AN ELLIPTIC SYSTEM WITH WEIGHTS AND MULTIPLE CRITICAL NONLINEARITIES

*Yamina Hamzaoui* [1]
Preparatory school in science commericial mathematic oran-Algeria [1]

We consider the solvability of the Neumann problem for an elliptic system of two equations with weights involving two critical Sobolev exponents on a bounded domain in RN. By using variational methods, we investigate the effect of the shape of the graph of the weight functions and the geometry of the boundary on the existence of solutions.

## POSTER PRESENTATIONS

**Category**: Relativity Theory
**Keywords:** dark energy, f-essence, fermionic Chaplygin gas
**Abstract No:** 1036

### THE EXACT SOLUTION OF EINSTEIN'S EQUATIONS WITH F-ESSENCE FOR THE CHAPLYGIN GAS

*Pyotr Tsyba* [1], Koblandy Yerzhanov [1], Olga Razina [1], Ratbay Myrzakulov [1]
Eurasian National University General and Theoretical Physics Astana-Kazakhstan [1]

Recently, it was proposed a new fermionic model of dark energy, the so-called f-essence. In this work, we first present fermionic Chaplygin gas models of dark energy corresponding to the usual Einstein-Dirac theory. Then we explicitly reconstruct the different f-essence models. In particular, these models include the fermionic Chaplygin gas and the fermionic generalized Chaplygin gas models of dark energy. We also derive the equation of state parameter of the selected f-essence models.

**Category**: Relativity Theory
**Keywords:** Alternative gravity, cosmology, torsion, exact solutions, Noether Symmetry Approach
**Abstract No:** 1041

### NOETHER SYMMETRY APPROACH FOR TELEPARALLEL-CURVATURE COSMOLOGY WITH F-ESSENCE

*Yerlan Myrzakulov* [1], Ratbay Myrzakulov [1]
Eurasian International Center for Theoretical Physics General and Theoretical Physics Astana-Kazakhstan [1]

We consider curvature-teleparallel F(R,T) gravity, where the gravitational Lagrangian density is given by an arbitrary function of the Ricci scalar R and the torsion scalar T. Using the Noether Symmetry Approach, we show that the functional form of the F(R,T) function, can be determined by the presence of symmetries . Furthermore, we obtain exact solutions through to the presence of conserved quantities and the reduction of cosmological dynamical system. Example of particular cosmological models are considered.

**Category**: Dynamical Systems
**Keywords:** Chaos synchronization, universal method, dynamical systems, algebraic conditions, new criterion.
**Abstract No:** 1054

### SYNCHRONIZATION FOR CHAOTIC AND HYPERCHAOTIC DYNAMICAL SYSTEMS IN CONTINUOUS-TIME

*Ahlem Gasri* [1]
Tebessa University Mathematics and informatics TEBESSA-Algeria [1]

Chaos synchronization has become an active research area, due to its potential applications in information processing such as secure communication. Various methods have been developed for chaos synchronization such as PL method, active and adaptive control, adaptative feedback technique, backstepping design and sliding mode control, etc. Many types of synchronization have been presented such as complete and anti-synchronisation types, generalized synchronization, projective synchronization, generalized projective synchronization, etc. The main aim of this paper is to derive simple algebraic conditions for global synchronization between two n-dimensional coupled of general chaotic dynamical systems in continuous-time. Based on Lyapunov stability theory and a new control design, a universal synchronization method is proposed to guarantee synchronization in n-D between master and slave chaotic systems in continuous-time. In order to verify the effectiveness of the proposed method, we apply it, firstly, to two 3-D chaotic systems: Genesio-Tesi system and the Rössler system. Secondly, to two 4-D hyperchaotic systems: the hyperchaotic Lorenz system and the hyperchaotic Chen system.

## POSTER PRESENTATIONS

**Category**: Mathematical Physics
**Keywords:** Fixed point, Variational inequality, Weak solution, Electro-elastic material, Tresca's friction.
**Abstract No:** 1057

### AN ANTIPLANE ELECTRO-VISCOELASTIC CONTACT PROBLEM WITH FRICTION

*Mohamed Dalah* [1]
University Mentouri Constantine of Mathematics Constantine-Algeria [1]

Purpose: We study a mathematical model which describes the antiplane shear deformation of a cylinder in frictionless contact with a rigide foundation. The material is assumed to be electro-elastic. First we derive the classical variational formulation of the model which is given by a system coupling an evolutionary variational equality for the displacement field and a time-dependent variational equation for the potential field. Then we prove the existence of a unique weak solution to the model. Moreover, the Proof is based on arguments of evolution equations and by using the fixed-point Theorem.

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Keywords:** Variable Besov spaces Pseudodifferential operators Non regular symbols
**Abstract No:** 1058

### BOUNDEDNESS OF NON REGULAR PSEUDODIFFERENTIAL OPERATORS ON VARIABLE BESOV SPACES

*wafa hebbache* [1]
univ- M'sila mathématique m'sila-Algeria [1]

We study the boundedness of non regular pseudodifferential operators, with symbols belonging to certain vector-valued Besov space, on Besov spaces with variable smoothness and integrabilty. These symbols include the classical Hörmander classes.

accepted in:
The Journal of Pseudo-Differential Operators and Applications

**Category**: Lie Theory and Symmetry Methods in Partial Differential Equations
**Abstract No:** 1071

### EXISTENCE AND BLOW-UP OF SOLUTIONS FOR DAMPED WAVE SYSTEM WITH NONLINEAR MEMORY

*Messaouda Terchi* [1]
university Mohamed KHider mathemathic Biskra -Algeria [1]

Our purpse in this paper is to study the global existence and uniquness of small data solutions for systems of semi linear damped wave equations with non linear mémory in R^{N} N= 1,2,3. Moreover, we derive the blow up result for any space dimensions.

In order to achieve this study, we are going to use lp and lq estimate of the fondamental solutions for linear damped wave equation and the test function for the proof of blow up part.

## POSTER PRESENTATIONS

**Category**: Lie Theory and Symmetry Methods in Integro-Differential Equations
**Abstract No:** 1076

### CLASSIFICATION OF GROUP INVARIANT SOLUTIONS OF NONLINEAR TIME FRACTIONAL DIFFUSION-WAVE EQUATION WITH SOURCE TERM

Khongorzul Dorjgotov [1], Hiroyuki Ochiai [2], *Uuganbayar Zunderiya* [2]
Kyushu University Graduate school of Mathematics Fukuoka-Japan [1] Kyushu University Institute of Mathematics for Industry Fukuoka-Japan [2]

In this talk, we present a study of nonlinear time fractional diffusion-wave equation with source term, given by
\begin{equation}\label{fisher}
\frac{\partial^\alpha u}{\partial t^\alpha}=(g(u) u_x)_x+f(u), \end{equation}
where $f(u)$ is an arbitrary differentiable function and $g(u)$ is a non-zero, arbitrary differentiable function, via group invariant analysis of a differential equation. Here the fractional derivative of order $\alpha$ is a Riemann-Liouville one. The equation (\ref{fisher}) can be used to describe the processes of subdiffusion for $\alpha\in(0,1),$ normal diffusion for $\alpha=1$, wave diffusion for $\alpha\in(1,2)$ and wave propagation for $\alpha=2.$

The equation (\ref{fisher}) has been studied by R. K. Gazizov et al. [1] and S. Yu. Lukashchuk et. al. [2] for arbitrary $g(u),$ $f(u)$. In these works, the complete classification of Lie symmetries of (1) and some particular invariant solutions have been obtained. Our talk can be considered as a completion of these work. We investigate the structure of Lie symmetry algebras and found that it consists of non-isomorphic seven types of Lie algebras. We construct one-dimensional optimal systems of Lie algebras of symmetries and the reduced ordinary differential equations of (1) corresponding to the symmetries of optimal systems. In other words, we obtain classification of invariant solutions of the equation (1). For particular cases we give explicit invariant solutions. \\\\
\textbf{References:}
\begin{enumerate}
\item R.K. Gazizov, A.A. Kasatkin, S. Yu. Lukashchuk: Symmetry properties of fractional diffusion equations. Phys. Scr. \textbf{T136}, 014016 (2009)
\item S. Yu. Lukashchuk, A.V. Makunin: Group classification of nonlinear time-fractional diffusion equation with a source term. Applied Mathematics and Computation \textbf{257}, 335-343, (2015).
\end{enumerate}

## POSTER PRESENTATIONS

**Category**: Lie Theory and Symmetry Methods in Ordinary Differential Equations
**Keywords:** Maple procedure, $\lambda-$symmetry, first integral, integrating factor
**Abstract No:** 1080

### SECOND-ORDER ORDINARY DIFFERENTIAL EQUATIONS ADMITTING TWO $\LAMBDA-$SYMMETRIES: A MAPLE PROCEDURE

*Juan Vidal* [1], Concepcion Muriel [2], Jose Mendoza [3], Adrian Ruiz [2]
Universidad De Cadiz Departamento De Ciencias Y Tecnicas De La Navegacion Y Construcciones Navales Cadiz-Spain [1] Universidad De Cadiz Departamento De Matematicas Cadiz-Spain [2] Universidad Del Atlantico Departamento De Matematicas Barranquilla-Colombia [3]

Two (standard or generalized) $\lambda-$symmetries of a given second-order ordinary differential equation can be used to solve the equation by quadratures. The method is based on the construction of two commuting generalized symmetries for this equation by using both $\lambda-$symmetries. From these generalized symmetries two independent first integrals of the equation arise by quadratures.

In this work we describe some routines, written for the Maple system, for second-order ordinary differential equations which admits two nonequivalent generalized $\lambda-$symmetries.

A first set of commands computes the canonical representatives of both generalized $\lambda-$symmetries and a procedure to construct two respectively equivalent $\lambda-$symmetries that commute. Then a first-order invariant for each generalized $\lambda-$symmetry can be found by quadratures. This is done by calculating two exact 1-differential forms and their corresponding primitives. These invariants are used to construct a new system of coordinates which simplifies the construction of the associated commuting generalized symmetries.

Provided that the equations involved in the first set of commands can be solved, the procedure continues by computing by quadratures two independent first integrals of the equation, associated to the initial $\lambda-$symmetries.

Finally several additional objects related to the integrability of the given equation can be derived as by-products of the algorithm. The routines provide a Jacobi last multiplier, two integrating factors for the original equation and integrating factors of the reduced and auxiliary equations associated to both $\lambda-$symmetries.

Particular examples of second-order ordinary differential equations lacking Lie point symmetries or admitting just one Lie point symmetry have been completely integrated by the application of the procedure.

## POSTER PRESENTATIONS

**Category**: Lie Theory and Symmetry Methods in Ordinary Differential Equations
**Keywords:** Lie symmetries, External granule layer, Granule cell generation, Cerebellum cells.
**Abstract No:** 1086

### SOLUTION OF THE GRANULE CELL GENERATION SYSTEMS WITH USING LIE SYMMETRY

*Mehmet KOCABIYIK* [1], Mevlüde YAKIT ONGUN [1]
Süleyman Demirel University Mathematics Isparta-Turkey [1]

In this study, we consider a model for the Granule Cell Generation systems which has been using in brain development. Our purpose is to get the general solutions of the system in brain development which obtained by the change of cerebellum grenule cells in EGL (External granule layer of the cerebellum). So Lie symmetry analysis is applied to find general solutions to Granule Cell Generation systems model. The basic point of view for this system will be obtained from general solutions depending on probability functions. This is the research for the solution of Granule Cell Generation system for three different probability function as linear function, rational function and exponential function

**Category**: Mathematical Physics
**Keywords:** Second-order ordinary differential equation, integral condition, Fredholm operator.
**Abstract No:** 1098

### BOUNDARY VALUE PROBLEM WITH INTEGRAL CONDITIONS FOR DIFFERENTIAL ORDINARY EQUATION

*Abdelhak Berkane* [1]
University of constantine Mathematics Constantine-Algeria [1]

A second-order ordinary differential equation with a spectral parameter and integral conditions is considered. An a priori estimate of the solution for sufficiently large values of the parameter is obtained and spectral properties of the corresponding operator are studied.

**Category**: Lie Theory and Symmetry Methods in Difference Equations
**Keywords:** Algorithmic Evaluation, Difference Standard and Janet Bases, Finite Difference Approximations, Involution Theory, Navier-Stokes Equations, Partial Differential Equations, Thomas Decomposition, Weak and Strong Consistency
**Abstract No:** 1105

### ON STRONGLY CONSISTENT FINITE DIFFERENCE APPROXIMATIONS

*Dmitry Lyakhov* [1], Vladimir Gerdt [2], Dominik Michels [1]
KAUST VCC Thuwal-Saudi Arabia [1] JINR LIT Dubna-Russia [2]

Finite difference schemes are widely used in computational physics to numerically solve partial differential equations. However, for a given solution scheme, it is usually difficult to generally evaluate the quality of their underlying finite difference approximation with respect to the considered physical problem. In this contribution, we introduce appropriate quality criteria; in particular, weak and strong consistency for finite difference approximations to systems of nonlinear partial differential equations. On this foundations, we devise a verication algorithm for strong consistency, which is based on the computation of difference standard bases. This allows for the evaluation and construction of solution schemes, which preserves fundamental algebraic properties of the system at the discrete level. We demonstrate our presented concept by evaluating finite difference approximations to the Navier-Stokes equations.

## POSTER PRESENTATIONS

**Category**: Lie Theory and Symmetry Methods in Ordinary Differential Equations
**Keywords:** Third-order differential inclusion, three point boundary value problem, fixed point theorem, selection theorem.
**Abstract No:** 1126

### EXISTENCE RESULTS FOR A THIRD-ORDER DIFFERENTIAL INCLUSION WITH THREE-POINT BOUNDARY VALUE PROBLEMS

*Smail Kelaiaia* [1]
University of Annaba Mathematics Annaba-Algeria [1]

We investigate the solutions for a third-order differential inclusion with three-point boundary value problem. We apply the Schaefer's fixed point theorem combined with a selection theorem due to Bressan and Colombo.

**Category**: Differential Geometry
**Keywords:** Vector field, complete lift, basic 1-form, semi-cotangent bundle
**Abstract No:** 1134

### SEMI-COTANGENT BUNDLE

*Furkan Yıldırım* [1]
Atatürk University Mathematics ERZURUM-Turkey [1]

Using the fiber bundle M over a manifold B, we define a semi-cotangent (pull-back) bundle t^{*}B, which has a degenerate symplectic structure. We consider lifting problem of projectable geometric objects on M to the semi-cotangent bundle. Also, relations between lifted objects and a degenerate symplectic structure are presented.

**Category**: Quantum Mechanics
**Keywords:**
**Abstract No:** 1136

### KALEIDOSCOPE OF QUANTUM COHERENT STATES

Oktay Pashaev [1], *Aygül Koçak* [1]
İzmir Institute of Technology Mathematics İzmir-Turkey [1]

The cat states as the superposition of Glauber coherent states generated by the Hadamard gate, represent qubit states and have been applied recently to description of a squeezed photon states. In our paper we derived the superposition of arbitrary number of coherent states generated by the Vandermonde unitary gate. It is associated with the n-th roots of unity and the regular n-polygon states. These states provide the set of arbitrary orthonormal quantum states, normalization of which is described by the set of generalized exponential functions with specific properties. This set of states represents kaleidoscope of Glauber coherent states, which is related with Kummer numbers.We show that these states can be used for description of qudit units of quantum information. Superpositions of three and four coherent states and their representation as qutrit and ququat quantum states are described in details.

The work of O.K.P. was supported by the Scientific and Technological Research Council of Turkey (TÜBİTAK), Grant No: TBAG-116F206.

SDEA - III

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# 3rd INTERNATIONAL CONFERENCE ON SYMMETRIES, DIFFERENTIAL EQUATIONS AND APPLICATIONS

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