4. How to Use the Schedule Book

The information of each talk is encoded as a 9/10-character string, AB-CD-e-f-xx-y, meaning that the talk of TYPE “AB” will be given in BUILDING “CD”, at FLOOR “e”, at ROOM “f”, on DATE & TIME “xx”, and in the PRESENTATION ORDER “y”.

The symbols are explained as follows:
Code: Type / Building / Floor / Room No. / Date & Time / Presentation order

TYPE:
- **SL** = Special Lectures
- **IL** = Invited Lectures
- **MS** = Minisymposia
- **IM** = Industrial Minisymposia
- **CP** = Contributed Papers
- **P** = Posters (**PA**: session on Monday-Tuesday; **PB** session on Wednesday; **PC** session on Thursday-Friday)

BUILDINGS:
- **A1** = Aulari I
- **A3** = Aulari III
- **A6** = Aulari VI
- **MA** = (air-conditioned) Marquee
- **ME** = Facultat de Medicina i Odontologia
- **PS** = Facultat de Psicologia
- **FT** = Facultat de Filologia, Traducció i Comunicació
- **FE**: = Facultat de Filosofia i Ciències de l’Educació
- **GH** = Facultat de Geografia i Història

FLOOR:
- **S** = Basement Level
- **0** = Ground Floor
- **1** = First Floor
- **2** = Second Floor
- **3** = Third Floor
- **4** = Fourth Floor

DATE & TIME:
- **1** = Monday 17:00h-19:00h
- **2** = Tuesday 11:00h-13:00h
- **3** = Tuesday 14:30h-16:30h
- **4** = Tuesday 17:00-19:00h
- **5** = Wednesday 11:00-13:00h
- **6** = Wednesday 14:30h-16:30h
- **7** = Wednesday 17:00h-19:00h
- **8** = Thursday 14:30h-16:30h
- **9** = Friday 11:00h-13:00h
- **10** = Friday 14:30h-16:30h

Examples:

MS-GH-1-1-2-3: Minisymposium, GH-Building, 1st floor, Room 1, Tuesday 11:00h-13:00h, Presentation order No. 3

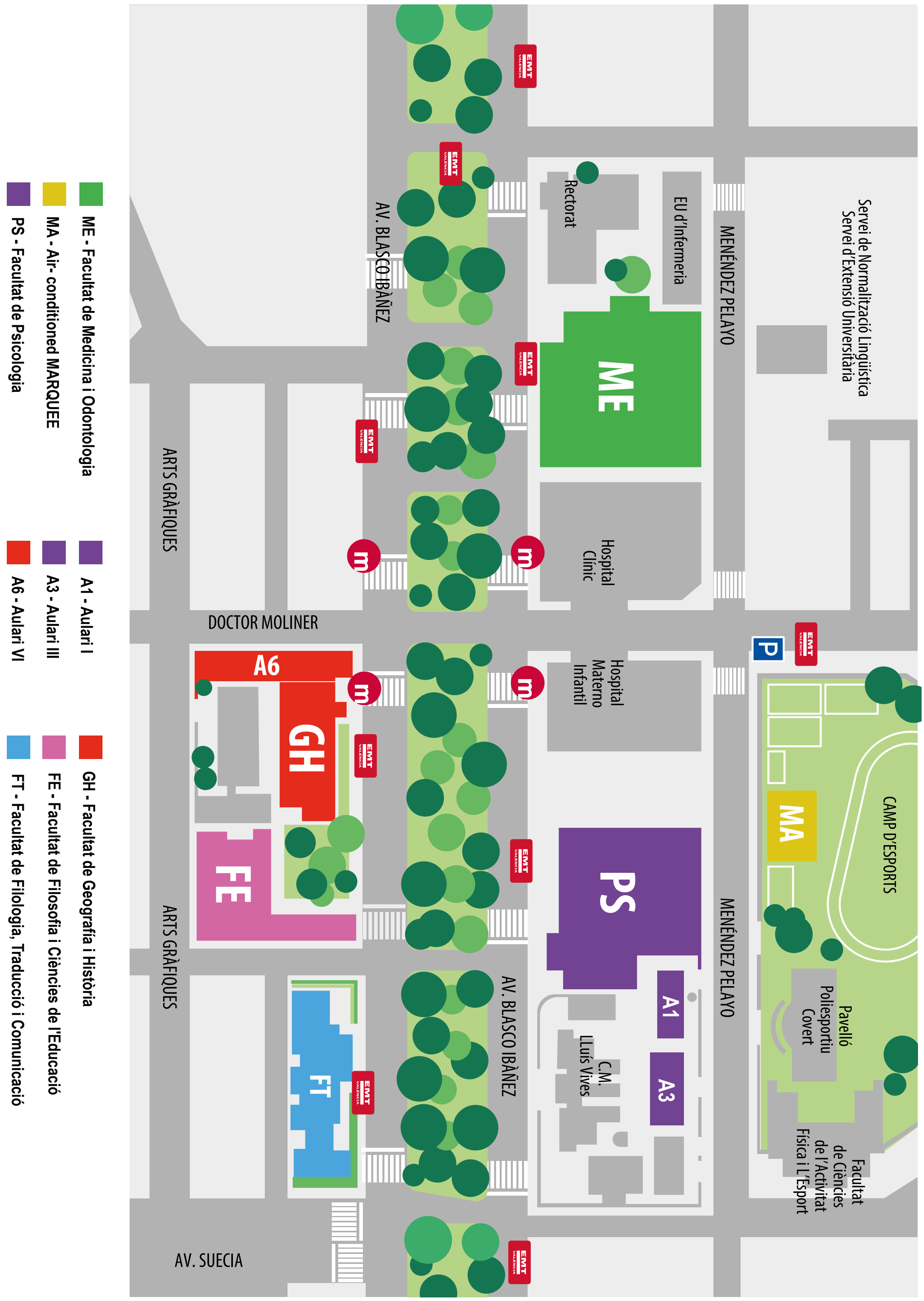
CP-A3-S-C2-9-1: Contributed Paper, A3-Building, Basement, Room C2, Friday 11:00h-13:00h, Presentation order No. 1

PROGRAM AT A GLANCE ICIAM 2019

TIME	SUNDAY JULY 14	MONDAY JULY 15	TUESDAY JULY 16	WEDNESDAY JULY 17 (INDUSTRY DAY)	THURSDAY JULY 18	FRIDAY JULY 19
Venue	Valencia Conference Centre (REGISTRATION, 17:00–21:00)	Valencia Conference Centre (REGISTRATION, 8:00–12:45); Universitat de València (REGISTRATION, 15:00–18:45)	Universitat de València (REGISTRATION)	Universitat de València (REGISTRATION)	Universitat de València (REGISTRATION); Palau de les Arts	Universitat de València (REGISTRATION)
8:00		REGISTRATION OPENS	REGISTRATION OPENS	REGISTRATION OPENS	REGISTRATION OPENS	REGISTRATION OPENS
8:15						
8:30			INVITED LECTURES (3 in Parallel 08:30h - 09:15h)	INVITED LECTURES (3 in Parallel 08:30h - 09:15h)	INVITED LECTURES (3 in Parallel 08:30h - 09:15h)	INVITED LECTURES (3 in Parallel 08:30h - 09:15h)
8:45						
9:00						
9:15						
9:30			INVITED LECTURES (3 in Parallel 09:30h - 10:15h)	INVITED LECTURES (3 in Parallel 09:30h - 10:15h)	INVITED LECTURES (3 in Parallel 09:30h - 10:15h)	INVITED LECTURES (3 in Parallel 09:30h - 10:15h)
9:45						
10:00		Opening Ceremony & AWARDS (10:00h - 11:15h)				
10:15						
10:30			COFFEE BREAK & POSTER SESSION (10:30h . 11:00h)	COFFEE BREAK & POSTER SESSION (10:30h . 11:00h)	COFFEE BREAK & POSTER SESSION (10:30h . 11:00h)	COFFEE BREAK & POSTER SESSION (10:30h . 11:00h)
10:45						
11:00			Scientific Sessions (11:00h - 13:00h)	Scientific Sessions (11:00h - 13:00h)	INVITED LECTURES (3 in Parallel 11:00h - 11:45h)	Scientific Sessions (11:00h - 13:00h)
11:15		COFFEE BREAK				
11:30						
11:45		Laudations for ICIAM prize winners (11:45h - 12:20h)				
12:00					ICIAM LAGRANGE PRIZE LECTURE (12:00h - 12:45h)	
12:15						
12:30		Olga Taussky-Todd LECTURE (12:30h - 13:15h)				
12:45						
13:00			LUNCH BREAK (13:00-14:30)	LUNCH BREAK (13:00-14:30)	LUNCH BREAK (13:00-14:30)	LUNCH BREAK (13:00-14:30)
13:15		LUNCH BREAK (13:15h - 15:00h)				
13:30						
13:45						
14:00						
14:15						
14:30			Scientific Sessions (14:30h - 16:30h)	Scientific Sessions (14:30h - 16:30h)	Scientific Sessions (14:30h - 16:30h)	Scientific Sessions (14:30h - 16:30h)
14:45						
15:00		ICIAM PIONEER PRIZE LECTURE (15:00 h - 15:45h)				
15:15						
15:30						
15:45		ICIAM COLLATZ PRIZE LECTURE (15:45 h - 16:30h)				
16:00						
16:15						
16:30		COFFEE BREAK & POSTER SESSION (16:30h - 17:00h)	COFFEE BREAK & POSTER SESSION (16:30h - 17:00h)	COFFEE BREAK & POSTER SESSION (16:30h - 17:00h)	COFFEE BREAK & POSTER SESSION (16:30h - 17:00h)	
16:45						Closing Ceremony (16:45h - 17:15h)
17:00		Scientific Sessions (17:00h - 19:00h)	Scientific Sessions (17:00h - 19:00h)	Scientific Sessions (17:00h - 19:00h)	ICIAM SU BUCHIN PRIZE LECTURE (17:00h - 17:45h)	
17:15						
17:30						
17:45					ICIAM MAXWELL PRIZE LECTURE (17:45h - 18:30h)	
18:00						
18:15						
18:30	WELCOME RECEPTION (18:30 h- 20:30h)					
18:45						
19:00						
19:15		Peter Henrici LECTURE (19:15h - 20:00h)	John von Neumann LECTURE (19:15h - 20:00h)	Sonia Kovalevsky LECTURE (19:15:20:00h)		
19:30						
19:45					Public Lecture (19:45h - 20:45h)	
20:00						
20:15						
20:30						
20:45						
21:00						

Venue

Blasco Ibáñez Campus of the Universitat de València



NLEVPs can be extended to multiparameter eigenvalue problems (MPEPs) F(x1,...,xd)v=0, w*F(x1,...,xd)=0, with F:Cd→Cnxn. Important cases of NLEVPs are the polynomial and rational eigenvalue problems, where the entries of F(x) are polynomial or rational functions. NLEVPs and MPEPs arise in many applications, and much research on these problems has been performed in the last years from computational and theoretical perspectives. This minisymposium presents the most recent advances in NLEVPs and MPEPs, and on their applications.

17:00-17:30

A survey on NLEVPs and multiparameter eigenvalue problems

Fernando De Terán — Universidad Carlos III de Madrid

Abstract: In this talk, intended for a broad audience, we will first review the notion on NLEVP and multiparameter eigenvalue problem, together with some of their basic features. Then, we will review some of their applications. Finally, we will present a survey on the main different approaches, techinques, and tools for the solution of NLEVPs and multiparameter eigenvalue problems presented so far in the literature.

17:30-18:00

Distance Problems for Matrix Polynomials via Block Toeplitz matrices

Shreemayee Bora — IIT GUWAHATI
Biswajit Das — IIT GUWAHATI

Abstract: Given a regular matrix polynomial, the distance to a nearest regular matrix polynomial with a Jordan chain of specified minimum length, and also the one to a nearest matrix polynomial with specified maximum normal rank are considered. In the latter case, particular focus is on nearest singular matrix polynomials. It is shown that certain block Toeplitz matrices provide an understanding of the relationship between their solutions and the location of nearest polynomials of interest.

18:00-18:30

Accuracy and stability of polynomial eigenvalue solvers based on linearization

Javier Perez Alvaro — University of Montana
Froilan M. Dopico — Universidad Carlos III de Madrid
Paul Van Dooren — Universite catholique de Louvain

Abstract: The standard way of solving numerically a polynomial eigenvalue problem is to use a linearization and solve the corresponding generalized eigenvalue problem. A rich source of structured and unstructured linearizations is the family of block-Kronecker pencils, which contains the well-known families of Fiedler and generalized Fiedler linearizations. In this talk, we will analyze some recent resuts on how the linearization process influences the conditioning and the accuracy of computed eigenvalues and eigenvectors.

18:30-19:00

Nonlinear eigenvalue problems and contour integration

Simon Telen

Abstract: Based on contour integration, nonlinear eigenvalue problems involving analytic matrix functions can be transformed into generalized eigenvalue problems. The contour integrals are approximated numerically by a quadrature formula, which corresponds to a filter function. In this talk the properties of such a filter function as well as its implications on the nonlinear eigenvalue approximation problem will be investigated.

MS A6-5-3 1 — 17:00-19:00

Mathematics and Computation for Clinical Problems - Part 1

For Part 2 see: MS A6-5-3 2
For Part 3 see: MS A6-5-3 3

Organizer: Hiroshi Suito — Tohoku University, Japan
Organizer: Takuya Ueda — Tohoku University
Organizer: Norikazu Saito — The University of Tokyo

Abstract: We shall present several topics that have arisen through collaboration between mathematical science and clinical medicine. Our targets include leading-edge technologies in clinical applications from 4D-flow MRI to machine learning applications. Together with these studies, strong mathematical foundations are indispensable for reliable and efficient implementations. Through close collaboration with physicians, those analyses can yield greater understanding leading to better risk assessments. Throughout this mini-symposium, we seek discussion of how mathematical science might contribute to the clinical medicine of our present and future society. This mini-symposium comprises three parts: I. Clinical applications; II. Computational modeling; and III. Mathematical tools and foundations.

17:00-17:30

Medical Application of Mathematical tools: What doctors expect from mathematical analysis.

Takuya Ueda — Tohoku University

Abstract: In recent years, computational fluid dynamics (CFD) has attracted considerable attention in cardiovascular medicine. In addition to traditional assessment based on anatomical information, the CFD-based approach provides an opportunity to gain novel insights into vascular pathophysiology by exploring the relationship between structure and biomechanical forces in flow dynamics. In this session, we will discuss how physiological parameters that is analyzed by CFD modeling impacts on the clinical medicine, especially focusing of aortic diseases.

17:30-18:00

Machine learning in anemia control for hemodialysis patients

Yoshiki Sugitani — Tohoku University
Hiroshi Suito — Tohoku University
Viet Huynh — Tohoku University
Toshiaki Ohara — Okayama University
Kazufumi Sakurama — Okayama University
Masaru Kinomura — Okayama University
Hiroshi Ikeda — Shigei Medical Research Hospital

Abstract: Against anemia, a major difficulty for hemodialysis patients, erythropoiesis-stimulating agents and iron supplements are used as preventive measures. Such treatments are usually administered by specialized physicians, most of whom cannot keep up with the increasing number of hemodialysis patients. We developed the AI diagnosis system for these two forms of medication by neural networks. Since the data set is inbalanced, we introduced efficient training methods such as class weights and thresholds.

18:00-18:30

Clinical application of 4D flow MRI

Hideki Ota — Tohoku University

Abstract: With the development of MRI hardware and software, 4D flow MRI that acquires three-dimensional blood flow velocity and encodes volume coverage has been available for the evaluation of various cardiovascular diseases. 4D flow MRI allows retrospective flow measurement at any cross-sections and 3D flow visualization through postprocessing. More advanced flow parameters based on fluid dynamics can also be obtained. The basics of 4D flow MRI and its clinical applications will be discussed in this presentation.

18:30-19:00

On the complexity required for clinically-relevant computational analysis of coronary atherosclerosis

Ryo Torii — University College London
Christos Bourantas — Barts Heart Centre and University College London

Abstract: Computational models have been utilised to provide more in-depth information, on top of imaging and/or catheterisation data, for diagnostic and future risk prediction of atherosclerotic disease in coronary arteries. Considering clinical context, it is important to provide meaningful data within reasonably short analysis time, especially in large cohort studies. We discuss the complexity required in such models, to be able to achieve an optimal balance between physiological representation and computational cost.

MS ME-0-5 1 — 17:00-19:00

Integrable systems and beyond - Part 1

For Part 2 see: MS ME-0-5 5
For Part 3 see: MS ME-0-5 6

Organizer: Baofeng Feng — University of Texas Rio Grande Valley
Organizer: Peter Miller — University of Michigan
Organizer: Sara Lombardo — Mathematical Sciences, School of Science, Loughborough University

Abstract: Integrable systems arise in various branches of applied mathematics, notably in the study of nonlinear wave propagation and in integrable probability or mathematical physics. These applications have benefited from the use of functional analysis, asymptotic analysis, as well as algebraic and geometric reasoning to study the underlying integrable systems. This session aims to bring together researchers applying a wide range of tools to integrable models in order to solve important and interesting applied problems.

17:00-17:30

Extreme superposition: rogue waves of infinite order and the Painlevé-III hierarchy

Peter Miller University of Michigan

Abstract: In joint work with Deniz Bilman and Liming Ling, we study a Riemann-Hilbert representation of the fundamental rogue wave solution of focusing NLS in the limit of large order, establishing the existence of a limiting profile in the near-field region where the solution has the largest amplitude. The limiting profile is a new solution of the same PDE which also satisfies ordinary differential equations of Painlevé type with respect to space and time.

17:30-18:00

Integrability and continuous wave instabilities: an algebraic-geometry approach

Matteo Sommacal Northumbria University
Sara Lombardo Loughborough University
Antonio Degasperis University of Rome "La Sapienza"

Abstract: A simple, direct construction of the eigenmodes of the linearization of 1+1, multicomponent, nonlinear, integrable systems, is employed to study the instabilities of continuous waves, as well as to classify the stability spectra, providing a necessary condition in the parameters for the onset of rational solitons. The theory will be presented using the example of the vector nonlinear Schrödinger equation. The derivation of the stability spectra is completely algorithmic and makes use of elementary algebraic-geometry.

18:00-18:30

Rogue Wave Type Solutions and Spectra of Coupled Nonlinear Schroedinger Equations

Sara Lombardo Loughborough University
Antonio Degasperis Physics, "Sapienza" Università di Roma, Italy
Matteo Sommacal Mathematics, Physics and Electrical Engineering, Northumbria University, Newcastle upon Tyne, UK

Abstract: We consider an integrable model describing the interaction of two waves, namely the system of two coupled nonlinear Schrödinger equations (Manakov model). We discuss linear stability properties by computing the stability spectrum and the gain function (or growth rate). In contrast with the nonlinear Schroedinger equation, different types of single rogue wave type solutions exist which correspond to different values of the spectral variable even in the same spectrum.

18:30-19:00

When J. Ginibre met E. Schroedinger

Thomas Bothner King's College London
Jinho Baik University of Michigan

Abstract: The real Ginibre ensemble consists of square real matrices whose entries are i.i.d. standard normal random variables. In sharp contrast to the complex and quaternion Ginibre ensemble, real eigenvalues in the real Ginibre ensemble attain positive likelihood. We will show that the limiting distribution of the largest real eigenvalue admits a closed form expression in terms of a distinguished solution to an inverse scattering problem for the Zakharov-Shabat system.

MS A3-S-C1 1 17:00-19:00

Deep Learning and Linear Algebra

Organizer: Alfred Peris Universitat Politecnica de Valencia
Organizer: Gilbbert Strang MIT

Abstract: Deep learning creates a function that (nearly) gives the known outputs from the sample inputs in the training data. This learning function F is a composition of affine functions and a standard nonlinear function: often ReLU(x) = max (0,x). The matrices A and bias vectors b in the affine functions Ax + b are the weights to be optimized in learning the data. The word "deep" indicates many layers of A, b, and ReLU in F. This session develops the mathematics, describes the software that has made deep learning so powerful, and shows some of its applications in biomedicine.

17:00-17:30

Deep Learning with Continuous Piecewise Linear Functions

Gilbert Strang Massachusetts Institute of Technology

Abstract: Deep learning produces a function that matches known outputs on a training set and also succeeds on unseen data from the same population. The function is continuous piecewise linear: a composition F = F_L (F_L-1(... (F_1))) of functions max ((Av + b) , 0). The depth is L. The weights A and b minimize the error between F(v) and the known output --- the difference is small even for new test data.

17:30-18:00

A Round Trip between Linear Algebra and Neural Networks via High Performance Computing

Enrique Quintana Universitat Politècnica de València

Abstract: This talk will review the connection between basic computational kernels from linear algebra, machine learning algorithms and deep learning frameworks. Among these kernels, we can find the general matrix-matrix multiplication as well as sparse variants of this operation. On the way back from our "trip", we will leverage machine learning techniques to i) estimate the execution time of linear algebra kernels on a computer and ii) select the best algorithm among several highly tuned implementations.

18:00-18:30

Community detection based architectures for deep learning: a fully automated framework for Likert-scales

Francisco Javier Pérez Benito Benito Universitat Politécnica de Valencia
J. Alberto Conejero Universitat Politécnica de Valencia
Juan Miguel García-Gómez Universitat Politécnica de Valencia
Esperanza Navarro Universitat de Valencia

Abstract: The principal disadvantage of models based on Deep Neural Networks (DNN) is that the architecture design requires prior knowledge in the study field. We present a methodology based on community detection within a conceptual-structured data framework to automatically construct the architecture. Results tested on a real database covering socio-demographic-data and the responses to four psychometric scales (COPE, EPQR-A, GHQ-28, MOS-SSS)-searching an estimation of happiness degree- showed better results compared to previous existing DNN architectures (D-SDNN).

18:30-19:00

Practical Deep Learning in the Classroom

Loren Shure MathWorks

Abstract: Deep learning is quickly becoming embedded in everyday applications. It's becoming essential for students to adopt this technology, almost regardless of what their future jobs are. We will highlight some of the mathematics needed to construct and understand deep learning solutions.

MS A3-3-L1 1 17:00-19:00

Recent advances on numerical methods and analysis of complex fluids - Part 1

For Part 2 see: MS A3-3-L1 2
For Part 3 see: MS A3-3-L1 3
For Part 4 see: MS A3-3-L1 4
For Part 5 see: MS A3-3-L1 5

Organizer: Zhonghua Qiao The Hong Kong Polytechnic University
Organizer: Hui Zhang Beijing Normal University

Abstract: The goal is to integrate advances in mathematics (theory, modeling, algorithms, simulations, high performance computing techniques) with new experimental data from complex fluids and biological systems, and targeted applications. The specific systems represented include liquid crystal flow, polymeric flow and magnetic fluids, phase-field and beyond these area.

17:00-17:30

Efficient numerical methods for a diffusive interface model with Peng-Robinson equation of state

Yuze Zhang The Hong Hong Polytechnic University
Zhonghua Qiao The Hongkong polytechnic university
Shuyu Sun King Abdullah University of Science and Technology
Tao Zhang King Abdullah University of Science and Technology

Abstract: A new multi-component diffuse interface model with the Peng-Robinson equation of state is developed. Initial values of mixtures

Abstract: The main objective of this minisymposium is to present some recent advances in reduced order methods for parameter-dependent problems. These types of problems may be expensive due to the calculations of partial differential equations systems together with a large number of values of the parameters. Hence, the reduced order methods is necessary to reduce the computational cost. Different reduced order modelling will be presented, such as POD or reduced bases. This minisymposium will bring together scientists to present their recent advances on reduced order methods applied to parameter-dependet problems, provide a forum for discussion and interaction in these methods.

11:00-11:30

Efficient adaptive ROMs using LUPOD on the fly

María Luisa Rapún — Universidad Politécnica de Madrid, UPM
Filippo Terragni — Universidad Carlos III de Madrid
José Manuel Vega — Universidad Politécnica de Madrid

Abstract: We accelerate time-dependent solvers for PDEs by improving the performance of adaptive low-dimensional models through a recent collocation strategy called LUPOD. The method combines on-the-fly (on demand) short runs of a numerical solver with a POD-based Galerkin integration. LUPOD is performed to identify small sets of snapshots and collocation points. The latter are used for both POD and Galerkin projection. Numerical experiments will be shown.

11:30-12:00

Reduced order modelling in bifurcating parametrised non-linear equations

Federico Pichi — SISSA, International School for Advances Studies.
Gianluigi Rozza — SISSA, International School for Advanced Studies

Abstract: We present the applicability of the reduced basis method in non-linear systems undergoing bifurcations. Bifurcation analysis is a complex computational task and the Reduced Order Models (ROM) can potentially reduce the computational burden by several orders of magnitude. Models describing bifurcating phenomena arising in several fields with interesting applications, from computational to quantum mechanics. Some of these studies are carried out in collaboration with A.T. Patera at MIT and A. Quaini at University of Houston.

12:00-12:30

A method for the problem of identification of surface sources in non-homogeneous media and their computational cost

Jose Julio Conde Mones — Benemérita Universidad Autónoma de Puebla
José Jacobo Oliveros Oliveros — Facultad de Ciencias Físico Matemáticas de la BUAP.
Lorenzo Héctor Juárez Valencia — Universidad Autónoma Metropolitana, Unidad Iztapalapa.
María Monserrat Morín Castillo — Facultad de Ciencias de la Electrónica de la BUAP.

Abstract: This work presents a method for the identification of defined surface sources on the separation interface of two homogeneous media. The method consists in recovering in stable form a source from the normal derivative of the solution of the Cauchy problem and the Laplace equation with Dirichlet boundary conditions using the Tikhonov regularization method and the method of recursive smoothing method. Some numerical examples are presented to validate the proposed method and their computational cost.

12:30-13:00

An Adaptive Method for Interpolating Reduced-Order Models Based on Matching and Continuation of Poles

Yao Yue — Max Planck Institute for Dynamics of Complex Technical Systems

Abstract: This work presents an adaptive parametric model order reduction method based on interpolating poles of reduced-order models. To match the poles correctly, a combinatorial optimization problem is introduced. A branch and bound optimization algorithm is proposed to avoid combinatorial explosion. Furthermore, a continuation technique is employed not only to further ease pole-matching, but also to guide the generation of a small set of reduce-order models that represent the parameter space.

MS ME-0-5 5 — 11:00-13:00

Integrable systems and beyond - Part 2

For Part 1 see: MS ME-0-5 1
For Part 3 see: MS ME-0-5 6

Organizer: Baofeng Feng — University of Texas Rio Grande Valley
Organizer: Sara Lombardo — Mathematical Sciences, School of Science, Loughborough University
Organizer: Peter Miller — University of Michigan

Abstract: Integrable systems arise in various branches of applied mathematics, notably in the study of nonlinear wave propagation and in integrable probability or mathematical physics. These applications have benefited from the use of functional analysis, asymptotic analysis, as well as algebraic and geometric reasoning to study the underlying integrable systems. This session aims to bring together researchers applying a wide range of tools to integrable models in order to solve important and interesting applied problems.

11:00-11:30

A deformation for the Kadomtsev–Petviashvili equation (KP) hierarchy

Baofeng Feng — University of Texas Rio Grande Valley

Abstract: It is observed that some bilinear equations to soliton equations such as the CH equation cannot be obtained within the framework of the KP theory. By introducing nonzero constant in pseudo-differential operators including the dressing operator, we attempt to give a modification of the KP theory. We will give the Sato equation and the corresponding tau functions. In addition, we will develop a family of bilinear equations which include the ones for the CH equation

11:30-12:00

The hyperbolic Ernst equation in a triangular domain

Julian Mauersberger — KTH Royal Institute of Technology
Jonatan Lenells — KTH Royal Institute of Technology

Abstract: In Einstein's theory of relativity, the interaction of two plane gravitational waves can be described mathematically by a Goursat problem for the hyperbolic Ernst equation in a triangular domain. In this talk, I will show how to use the integrable structure of the hyperbolic Ernst equation to present the solution of the Goursat problem in terms of a corresponding Riemann--Hilbert problem. Our results treat uniqueness, existence and regularity, and a representation formula of the solution.

12:00-12:30

From integrability of nonlinear differential-difference equations to integrability of nonlinear PDEs

Zuonong Zhu — Shanghai Jiao Tong University

Abstract: In this talk, we will address the topic that from integrability of nonlinear differential-difference equations to integrability of nonlinear PDEs. We will take the Hirota equation as an example. We will show how to get the integrability of the Hirota equation from the integrability of our space discrete Hirota equation. This is a joint work with A. Pickering, and H.Q. Zhao.

12:30-13:00

Rigorous Asymptotic of a KdV Soliton Gas

Robert Jenkins — Colorado State University
Manuela Girotti — John Abbott College
Tamara Grava — University of Bristol / SISSA
Ken McLaughlin — Colorado State University

Abstract: We analytically study the long-time/large-space asymptotics of a broad class of solutions of KdV introduced by Dyachenko, Zakharov, and Zakharov. These solutions are characterized by a Riemann-Hilbert problem which we show arises as the limit of a gas of -solitons. We establish an asymptotic description for large times that is valid over the entire spatial domain, in terms of Jacobi elliptic functions.

MS FE-1-4 5 — 11:00-13:00

Multiscale analysis and numerical methods for oscillatory PDEs - Part 1

For Part 2 see: MS FE-1-4 6
For Part 3 see: MS FE-1-4 7
For Part 4 see: MS FE-1-4 8

Organizer: Yongyong Cai — Beijing Computational Science Research Center
Organizer: Carles Remi — CNRS & Univ Rennes
Organizer: Hanquan Wang — Yunnan University of Finance and Economics

Jingrun Chen Soochow University
Lin Ling Sun Yat-Sen University
Zhiwen Zhang The University of Hong Kong, China
Xiang Zhou City University of Hong Kong, China

Abstract: Exciton diffusion length plays a vital role in the function of opto-electronic devices. Oftentimes, the domain occupied by a organic semiconductor is subject to surface measurement error. The experimental result is sometimes found to be sensitive to the surface geometry of the domain. From numerical results we find that the correlation length of randomness is important to determine whether a 1D reduced model is a good surrogate.

MS A3-2-3 6 **14:30-16:30**

Kinetic modelling and multiscale simulation of nonequilibrium flow dynamics - Part 6

For Part 1 see: MS A3-2-3 1
For Part 2 see: MS A3-2-3 2
For Part 3 see: MS A3-2-3 3
For Part 4 see: MS A3-2-3 4
For Part 5 see: MS A3-2-3 5

Organizer: Lei Wu UK/University of Strathclyde
Organizer: Kun Xu Hong Kong University of Science and Technology
Organizer: Song Jiang Institute of Applied Physics and Comput. Math

Abstract: The Boltzmann equation underpins a board range of applications ranging from high-altitude aerothermodynamics of space vehicles, gas dynamics in micro-electro-mechanical systems, and shale gas extractions. It has also been extended to different fields, such as granular gases, radiative transfer, phonon/electron transport, plasmas, and quantum/relativistic dynamics. However, the high-dimensional integro-differential equations pose great challenges to the numerical simulation of kinetic equations and their applications. The goal of this minisymposium is to explore recent trends and developments in the kinetic theory (simplification of Boltzmann equations, reactions) and multiscale numerical simulation of non-equilibrium dynamics from the continuum to free-molecular flow regimes.

14:30-15:00

The method of fundamental solutions for simulating low-speed non-equilibrium gas flows

Duncan Lockerby Warwick University

Abstract: Fundamental solutions to linearised moment equations are used to predict the external creeping flow around a variety of 3D geometries (spheres, ellipsoids, tori, and others) at moderate Knudsen number. The scope for extending the Method of Fundamental Solutions to deal with multiple interacting bodies is explored.

15:00-15:30

Unified gas kinetic scheme for disperse multiphase flow

Chang Liu Hong Kong University of Science and Technolog
Chang LIU Hong Kong University of Science and Technology

Abstract: We propose a unified gas kinetic scheme for multiphase dilute gas-particle system, which captures flow physics in the regimes from collisionless multispecies transport to the two-fluid hydrodynamic Navier-Stokes (NS) solution with the variation of Knudsen number, and from granular flow regime to dusty gas dynamics with the variation of Stokes number. The UGKS-M shows a good multiscale property in capturing the particle trajectory crossing (PTC), article wall reflecting phenomena, etc.

15:30-16:00

Quadrature-based lattice Boltzmann models for relativistic hydrodynamics and applications in quark-gluon plasma

Victor Ambrus West University of Timisoara
Calin G. Guga-Rosian West University of Timisoara

Abstract: Both theoretical and experimental evidence indicate that the quark-gluon plasma (QGP) behaves as a nearly perfect relativisic fluid. Due to the extremely short lifetime of the QGP in accelerator experiments, a kinetic description is more appropriate than the macroscopic hydrodynamic approach. In this talk, we present a quadrature-based finite-difference lattice Boltzmann (FDLB) algorithm for obtaining numerical solutions of the relativistic Boltzmann equation with the Anderson-Witting single relaxation time approximation for the collision term.

16:00-16:30

Assessment of kinetic boundary conditions in rarefied gas dynamics

Lei Wu University of Strathclyde

Abstract: The gas kinetic boundary condition that describes how the gas molecules are reflected at the solid surface is complicated and important in rarefied gas flow simulations. By developing an efficient method to solve the Boltzmann equation efficiently and accurately, we assessed the accuracy of various boundary conditions in low-speed rarefied gas flows. We then found that significant drag reduction can be achieved when using certain types of boundary conditions.

MS ME-0-5 6 **14:30-16:30**

Integrable systems and beyond - Part 3

For Part 1 see: MS ME-0-5 1
For Part 2 see: MS ME-0-5 5

Organizer: Baofeng Feng University of Texas Rio Grande Valley
Organizer: Sara Lombardo Mathematical Sciences, School of Science, Loughborough University
Organizer: Peter Miller University of Michigan

Abstract: Integrable systems arise in various branches of applied mathematics, notably in the study of nonlinear wave propagation and in integrable probability or mathematical physics. These applications have benefited from the use of functional analysis, asymptotic analysis, as well as algebraic and geometric reasoning to study the underlying integrable systems. This session aims to bring together researchers applying a wide range of tools to integrable models in order to solve important and interesting applied problems.

14:30-15:00

On Boussinesq-Klein-Gordon and Ostrovsky equations and apparent zero-mass contradiction

Karima Khusnutdinova Loughborough University

Abstract: I will discuss a weakly-nonlinear solution of the Cauchy problem for the Boussinesq-Klein-Gordon (BKG) equation in the class of periodic functions on a finite interval. We consider the deviation from the oscillating mean and construct an explicit d'Alembert-type solution in terms of solutions of two Ostrovsky equations. Importantly, initial conditions for the Ostrovsky equations by construction have zero mean, while initial conditions for the BKG equation may have non-zero means. Joint work with Matthew Tranter.

15:00-15:30

Rational solutions to higher order Painlevé equations. Part II: complete classification

David Gomez-Ullate Oteiza Universidad Complutense de Madrid

Abstract: We introduce a new representation for rational solutions of the A2k - Painlevé system (a.k.a. Noumi-Yamada system). These solutions are indexed by cyclic Maya diagrams and expressed as Wronskian determinants of suitably chosen sequences of Hermite polynomials. We show that all known rational solutions “with a name” (e.g. Okamoto, Umemura, generalized Hermite, etc.) are just particular cases that fit into this larger scheme.

15:30-16:00

Multi-component Curie-Weiss model

Oleg Senkevich Northumbria University, Newcastle
Antonio Moro Northumbria University, Newcastle
Adriano Barra Salento University

Abstract: Multi-component Curie-Weiss model is a binary spin model on a complete graph which consists of several distinct CW-models connected to each other with the couplings that can be different from the internal couplings within the components. In this work the thermodynamic equations of state for this model are derived using the PDE-based approach, and the detailed analysis of the 2-component case is done using the elements of singularity theory.

MS A1-2-1 6 **14:30-16:30**

Networks, walks and matrix functions: new trends, results, potential issues - Part 2

A dynamic multilayer shallow water model for polydisperse sedimentation, Part II

Enrique D. Fernández Nieto — Universidad de Sevilla
Raimund Bürguer — Universidad de Concepción (Chile)
Victor Osores — Universidad de Concepción (Chile)

Abstract: In this work we study 3D simulations of polydisperse sedimentation with compression effects in a viscous fluid. A multilayer shallow water approach is considered with an assymptotic analysis of the model. A modification of the Masliyah-Lockett-Bassoon (MLB) settling velocities of each species is proposed. A numerical method is proposed, based on a generalization of HLL method. Finally, several numerical tests will be presented.

MS FT-2-3 7 — **17:00-19:00**

Advanced numerical methods for differential equations - Part 1

For Part 2 see: MS FT-2-6 8

Organizer: Lemou Mohammed — CNRS, university of Rennes 1
Organizer: Mechthild Thalhammer — University of Innsbruck
Organizer: Chartier Philippe — Inria Rennes Bretagne Atlantique

Abstract: The intention of this minisymposium on "Advanced numerical methods for differential equations" is to bring together experts in the field, interconnected through their area of application or the numerical methods used. The scope of topics in particular includes Schrödinger equations, kinetic equations, exponential integrators, splitting methods.

17:00-17:30

Symplectic propagators for the Kepler problem with time-dependent mass

Sergio Blanes — Polytechnic University of Valencia
Philipp Bader — University Jaume I, Spain
Fernando Casas — University Jaume I, Spain
Nikita Kopylov — Norwegian University of Science and Technology (NTNU)

Abstract: We show how to obtain numerical integrators specifically designed for solving the two-body gravitational problem with a time-varying mass. These methods are obtained taking into account an appropriate time-average on the non-autonomous equation. They can be seen as a generalization of commutator-free quasi-Magnus exponential integrators and are based on the compositions of symplectic flows using the mapping that solves the autonomous problem with averaged masses at intermediate stages. Methods up to order eight are constructed.

17:30-17:57

Composition methods for the time integration of kinetic equations

Fernando Casas — Universitat Jaume I

Abstract: Splitting and composition methods have been recently used for the time integration of Vlasov equations appearing in the simulation of plasma physics problems, and in particular for the Vlasov--Maxwell equation. Taking advantage of the separation of the problem into three solvable parts, we propose new and efficient composition methods up to order four in time. In this talk we detail the construction strategy and illustrate the new schemes on some numerical examples.

18:00-18:30

New Gross-Pitaevskii type models for Bose -Einstein condensates

Norbert Mauser — WPI Vienna

Abstract: The Gross-Pitaevskii equation, a cubic Nonlinear Schrodinger equation with confinement potential, is the classical “mean field” model for (numerical simulation of) Bose Einstein Condensates (BEC). We discuss extensions of the GPE (with quartic and quintic terms), including “temperature”, quantum noise, decoherence, etc. for dipolar, rotating BEC, e.g. “stochastic GPE”, and their application to numerical modeling of recent BEC experiments. We also deal with optimal control of eGPE for self-bound dipolar droplet formation, related to “supersolids”.

MS A1-2-4 7 — **17:00-19:00**

Geometric and learning-based models for 2D/3D Imaging and Applications

Organizer: Ronald Lok Ming Lui — The Chinese University of Hong Kong

Abstract: To analyze 2D/3D image data, image processing is an essential pre-processing. Conventional approaches usually rely on regularizing the image data. Recently, researches have been carried out to study how geometric information can be incorporated to enhance the mathematical models. Besides, in the era of big data, it is believed the combination of machine learning techniques to learn from data into the imaging models can further improve the results. In this minisymposium, researchers in this field will share their recent research works about geometric models and learning-based models for 2D/3D imaging and discuss their applications.

17:00-17:30

GANs, Optimal Transportation and Monge-Ampere Equation

David Xianfeng Gu — Stony Brook University

Abstract: Generative Adversarial Net is a powerful machine learning mode. The generator and the discriminator in a GAN model competes each other and reaches the Nash equilibrium. GAN generates samples, therefore reduce the requirements for large amount of training data. It also models distributions from data samples. However, GAN model lacks theoretic foundation. We give a geometric interpretation to optimal mass transportation theory, explain the relation with Monge-Ampere equation, and apply it for the GAN model.

17:30-18:00

QC Mapping and Ricci curvature

Emil Saucan — ORT Braude College

Abstract: Based on a discretization of the Bochner-Weitzenböck formula, Forman's Ricci curvature is simple and flexible in computations, thus rendering it, and its associated Ricci flow, as an adaptable tool for various applications. The most direct among such applications is to the fields of Imaging and Graphics, and we present its uses for such tasks as change detection in medical images, detection of man-made objects in aerial images and high dynamic range (HDR) imaging.

18:00-18:30

Curvature of Shape Spaces: Example of the Space of Landmarks

Sergey Kushnarev — SUTD

Abstract: In this talk I will introduce the simplest shape space, space of landmarks. I will demonstrate various examples of landmark configurations and the corresponding sectional curvatures. Numerical implementation of the curvature computation will be discussed. Then I will discuss the impact of the curvature on the statistical inference on landmark manifolds.

18:30-19:00

Conforming v.s. Non-conforming methods for solving geometric variational problems

Thomas P. Yu — Drexel University

Abstract: We compare two classes of numerical methods for geometric variational problems (e.g. Willmore, Canham-Helfrich-Evans, Hawking mass) based on piecewise linear (PL) and subdivision surfaces (SS) . We show that a non-conforming method based on any of the available curvature operators for PL surfaces (e.g. the `cotangent formula' for mean-curvature) fails to gamma-converge for the Willmore problem, whereas a conforming method based on SS succeeds. We discuss the consequences of these results.

MS ME-1-2 7 — **17:00-19:00**

Recent Advances in Applied Integrable Systems: Theory and Computations - Part 1

For Part 2 see: MS ME-1-2 8
For Part 3 see: MS ME-1-2 9
For Part 4 see: MS ME-1-2 10

Organizer: Kenichi Maruno — Waseda University
Organizer: Anton Dzhamay — University of Northern Colorado

Abstract: Recent advances in the applications of integrable systems extend to a wide range of mathematics and physical sciences, such as random matrices, cluster algebra and combinatorics, probability theory, numerical computations, cellular automata, tropical geometry and ultra-discrete systems, differential geometry, computer visualizations, nonlinear physics, and many others. The purpose of this mini-symposium is to bring together active researchers from across the world to discuss recent developments in various aspects of applied integrable systems.

17:00-17:30

Discrete Painlevé Equations in Tiling Problems

Anton Dzhamay — University of Northern Colorado

Alisa Knizel Columbia University

Abstract: The role of discrete Painlevé equations for applications has recently been steadily growing. However, to effectively use the these equations often requires finding a highly non-trivial change of coordinates from the application coordinates to the Painlevé coordinates. In this talk we illustrate the techniques of doing so using Sakai's geometric theory of Painlevé equations. The application we consider is related to computing gap probabilities for lozenge tilings of a hexagon with generalized q-Racah weights.

17:30-18:00

Mutation combinatrics in Cluster algebras and q-Painleve equations

Teruhisa Tsuda Hitotsubashi University
Tetsu Masuda Aoyama gakuin university
Naoto Okubo Aoyama gakuin university

Abstract: Cluster algebra is an algebraic structure generated by operations of a quiver called the mutations and their associated simple birational mappings. We introduce a systematic derivation of tropical, i.e., subtraction-free birational, representation of Weyl groups. Our result is related with a class of tropical representation of Weyl groups acting on certain rational varieties and also (higher-order) q-Painleve equations. Key ingredients of the argument are the combinatorial aspects of reflections associated with n-cycles in the quiver.

18:00-18:30

Algebro-geometric solutions to Schlesinger and Painlevé VI equations

Vladimir Dragovic The University of Texas at Dallas

Abstract: New methods of construction of algebro-geometric solutions of Schlesinger systems and related Painleve VI equations are presented. They are based on study of differentials on elliptic, hyperelliptic and superelliptic curves. The research has been partially supported by the NSF grant 1444147. This presentation is based on joint works with Vasilisa Shramchenko and a joint work with Renat Gontsov and Vasilisa Shramchenko.

18:30-19:00

Noncommutative Painlevé equations of Calogero Type

Marco Bertola Concordia University and SISSA
Mattia Cafasso University of Angers
Volodya Rubtsov University of Angers

Abstract: The Calogero-Moser-Sutherland system is an autonomous integrable Hamiltonian system of particles on the line with inverse square potential. The non-interacting part is a classically integrable Hamiltonian (e.g. the harmonic oscillator). The goal of the talk is to explain how the integrability survives if we replace the single-particle Hamiltonian by any of the Hamiltonian for the six Painleve equation thus solving a conjecture posed by Takasaki in 2010. Joint work with M. Cafasso and V. Rubtsov.

MS ME-0-8 7 — 17:00-19:00

Singular Limits in Fluid Dynamics, Related Equations, and Numerical Analysis - Part 4

For Part 1 see: MS ME-0-8 4
For Part 2 see: MS ME-0-8 5
For Part 3 see: MS ME-0-8 6

Organizer: Steve Schochet Tel Aviv University
Organizer: Bin Cheng University of Surrey
Organizer: Qiangchang Ju IAPCM

Abstract: Many areas of physics are described by two models, one derived from basic laws and the second simplified using additional assumptions. Prominent pairs include compressible and incompressible fluid or magneto-hydrodynamic models, kinetic and fluid models, and many-body systems and mean-field theories. Clarifying relationships between models increases understanding of corresponding physical systems and guides development of improved numerical methods. This minisymposium examines current techniques for justifying simplified models via singular limits, quantifying the difference between solutions to related models, and simulating them numerically. Techniques to be discussed include classical, relative, and discrete energy and entropy estimates, and averaging methods.

17:00-17:30

On the numerical approximation of time-scale separated PDEs

Beth Wingate University of Exeter

Abstract: I will discuss the role of time-scale separation and nonlinear resonance in the numerical approximation of PDEs with oscillatory stiffness.I will introduce an integrator where we have used a strategy of rotating the PDEs into the solution space of the wave motion and how that leads to a 'modulated PDE'. I will discuss some of the issues important in proving convergence of a time-parallel (parareal) integrator for finite time scale separations.

17:30-18:00

Asymptotic preserving schemes for singular limits in compressible fluids

Maria Lukacova University of Mainz

Abstract: We present IMEX finite volume schemes for the Euler equations to approximate singular limits of weakly compressible flows. To resolve efficiently slow dynamics we split the system in a stiff linear part for the acoustic and a non-stiff nonlinear part for the nonlinear advection. We prove that the methods are asymptotically consistent and stable uniformly w.r.t. Mach number. We also report on uniform error analysis for the isentropic Navier-Stokes equations using a relative entropy functional.

18:00-18:30

Singular limits and error estimates for inviscid fluid dynamics in domains of non-trivial geometry

Bin Cheng University of Surrey

Abstract: For PDEs modelling inviscid fluid dynamics in physical domains, boundary conditions and/or non-flat geometry impose challeges that are further complicated in the singular limit problems. Recent progress has been made on not only uniform-in-parameter energy estimates and convergence to the limits, but also on convergence rates, namely error estimates between solutions to the original and to the limiting problems. All domains are compact and fast waves don't vanish when the separation of scales widens.

18:30-19:00

Singular limits of the compressible MHD system

Fucai Li Nanjing University

Abstract: In this talk we shall discuss two kinds of singular limits to the isentropic compressible viscous magnetohydrodynamic equations in a bounded domain Ω⊂R3. One is the incompressible limit, and the other is the inviscid limit. In the first case, the initial data are assumed to be ``ill-prepared``. In the other case, the initial data are assumed to be ``well-prepared. In both two cases, we obtain the convergence results. Some related results are also reviewed.

MS A6-2-2 7 — 17:00-19:00

Eigenvalue problems: perturbation and structure preservation - Part 1

For Part 2 see: MS A6-2-2 8

Organizer: Julio Moro Universidad Carlos III de Madrid
Organizer: Christian Mehl TU Berlin

Abstract: Structure-preserving eigenvalue algorithms are a common tool in numerical practice, since they often speed up computations, are potentially more accurate, and usually produce computed quantities reflecting more intrinsically the specific properties of the underlying matrix structure. Analyzing such algorithms requires a corresponding perturbation theory, describing the behavior of eigenvalues under structure-preserving perturbations. Sometimes such a theory is tricky to derive, due to classical perturbation theory clashing with the specific spectral properties of the structure under examination. The goal of this minisymposium is to report recent developments on both structure preservation and perturbation theory, either separately, or interacting with each other.

17:00-17:30

Structured perturbation of eigenvalues of symplectic and Hamiltonian matrices

Julio Moro Universidad Carlos III de Madrid
Fredy Sosa Universidad Carlos III de Madrid
Christian Mehl Technische Universität Berlin

Abstract: For certain matrix structures, perturbations which preserve that structure modify eigenvalues very differently from how arbitrary perturbations do. Two such families of matrices are symplectic and Hamiltonian ones. In this talk a detailed first-order structured perturbation analysis is presented for both classes. One of the main features of the analysis is framing symplectic perturbations in a multiplicative, instead of additive, way. Expansions for Hamiltonian perturbations are then derived from symplectic ones via the Cayley transform.

regularity and Gaussian-type estimates of a stochastic fundamental solution. Our method is based on a Wentzell's reduction of the SPDE to a PDE with random coefficients to which we apply a revised parametrix technique to construct a fundamental solution.

15:00-15:30

Liquidity induced asset bubbles via flows of ELMMs

Andrea Mazzon — Ludwig-Maximilians Universität

Abstract: We consider a model for bubbles, where the market price W is determined by trades of investors and the fundamental price W^F is exogenously given. We show the existence of a flow of equivalent martingale measures for W, under which W^F equals the expectation of discounted future dividends. We study bubble evolution in a network through contagion processes spreading among investors. We investigate how the shape of the network impacts the growth of the bubble.

15:30-16:00

Deep learning based methods for stochastic optimal control

Kristoffer Andersson — CWI
Kristoffer Andersson — CWI
Adam Andersson — Syntronic
Gustaf Ehn — Syntronic
Arnulf Jentzen — ETH Zurich
Mihály Kovács — Chalmers University of Technology

Abstract: We present two methods for solving stochastic optimal control problems with finite time horizon. The first method is based on solving backward stochastic differential equations approximately by means of time discretization and deep learning. The second method solves the control problem by approximating the gradient of the associated value function with deep learning in order to minimize the cost functional. The methods are discussed and compared by means of the control cost for different examples.

16:00-16:30

Probabilistic results concerning smoothness of the value function and of the free boundary in optimal stopping

Tiziano De Angelis — The University of Leeds

Abstract: I will present probabilistic proofs of some regularity properties for the value function and the optimal boundaries of optimal stopping problems. In particular this talk focusses on C^1 regularity of the value function and Lipschitz continuity of the optimal boundary. Most of our arguments rely on fundamental concepts from the theory of Markov processes and I will also illustrate situations in which our work improves or complements known facts from PDE theory.

MS ME-1-2 8 — 14:30-16:30

Recent Advances in Applied Integrable Systems: Theory and Computations - Part 2

For Part 1 see: MS ME-1-2 7
For Part 3 see: MS ME-1-2 9
For Part 4 see: MS ME-1-2 10

Organizer: Kenichi Maruno — Waseda University
Organizer: Anton Dzhamay — University of Northern Colorado

Abstract: Recent advances in the applications of integrable systems extend to a wide range of mathematics and physical sciences, such as random matrices, cluster algebra and combinatorics, probability theory, numerical computations, cellular automata, tropical geometry and ultra-discrete systems, differential geometry, computer visualizations, nonlinear physics, and many others. The purpose of this mini-symposium is to bring together active researchers from across the world to discuss recent developments in various aspects of applied integrable systems.

14:30-15:00

Integrable systems over novel fields

Rod Halburd — University College London

Abstract: Natural analogues of differential and difference equations with solutions defined on functions fields over finite fields will be discussed. Analogues in this setting of important special functions such as the exponential, gamma and hypergeometric functions have been discovered by Carlitz, Goss, Thakur and others. We will describe some integrable equations in this setting and the role played by singularity analysis.

15:00-15:30

Coprimeness-preserving extensions to discrete integrable systems

Masataka Kanki — Kansai University

Abstract: We present a class of equations with a so-called coprimeness property. The coprimeness property is one of the integrability detectors for discrete equations, with an emphasis on the algebraic aspect of the singularity confinement test. One of the equations we introduce is an extension of the discrete KdV equation to a higher dimensional integer lattice. The equation is non-integrable and yields a class of coprimeness-preserving equations including the Hietarinta-Viallet equation.

15:30-16:00

Dynamics of the box-ball system with random initial conditions

Satoshi Tsujimoto — Kyoto University
David Croydon — Kyoto University
Tsuyoshi Kato — Kyoto University
Makiko Sasada — Tokyo University

Abstract: We explore the dynamics of the BBS, introduced by Takahashi and Satsuma, started from random initial conditions. We show that the model can be described using the transformation of a nearest neighbour path encoding of the particle configuration given by `reflection in the past maximum'. Then we analyse various probabilistic properties of the BBS such as the asymptotic behavior of the integrated current of particles and of a tagged particle.

16:00-16:30

Continuous Game of Life using Max-Pluls Expression

Daisuke Takahashi — Waseda University

Abstract: Game of life is a famous two-dimensional evolutional cellular automaton as a simple model of life creating various moving patterns. In my talk, a continuous version of this game is presented. It is constructed using max-plus expression and sum of values of neighboring domain. It includes the original game of life as a special case and some patterns of original game are unified as special solutions of max-plus version.

MS A3-3-2 8 — 14:30-16:30

Mathematical descriptions of traffic flow: micro, macro and kinetic models - Part 1

For Part 2 see: MS A3-3-2 9
For Part 3 see: MS A3-3-2 10

Organizer: Andrea Tosin — Politecnico di Torino
Organizer: Gabriella Puppo — La Sapienza Università di Roma

Abstract: Traffic flow is a complex phenomenon, which impacts heavily on society, economy and everyday life. In the last few years, several new technologies, such as driver assist devices or online congestion information, have raised the need for a better understanding of traffic. In this minisymposium, we will gather several researchers in the field to explore the mathematical foundations of traffic models from different perspectives. The motivation is both to assess the state of the art and the interplay between the different approaches and to discuss how to meet the new challenges of traffic control, autonomous vehicles and emission reduction.

14:30-15:00

From kinetic to macroscopic models and back

Gabriella Puppo — La Sapienza Università di Roma
Michael Herty — RWTH Aachen University
Sebastiano Roncoroni — University of Reading
Giuseppe Visconti — RWTH Aachen University

Abstract: We study kinetic models for vehicular traffic flow. Classical formulations, as the BGK equation, lead to unconditionally unstable solutions in the congested regime of traffic. We address this issue by deriving a modified formulation of the BGK-type equation. The new kinetic model allows to reproduce conditionally stable non-equilibrium phenomena in traffic flow. The BGK-type model introduced here also offers the mesoscopic description between the follow-the-leader model and the Aw-Rascle and Zhang model.

15:00-15:30

Non-local vehicular traffic flow models

Felisia Angela Chiarello — Inria Sophia Antipolis - Méditerranée
Paola Goatin — Inria Sophia Antipolis-Méditerranée

Abstract: In this talk, I will consider the framework of the non-local traffic flow models. I will prove the well-posedness of entropy weak solutions for a class of non-local scalar conservation laws. After that, I will prove the existence for small times of weak solutions for a class of non-local

Roland Herzog TU Chemnitz
Ronny Bergmann TU Chemnitz
Marc Herrmann University of Würzburg
Stephan Schmidt University of Würzburg
José Vidal Núñez TU Chemnitz
Abstract: The total variation (TV) is an important regularizing seminorm in inverse problems. We consider problems where the shape is among the unknowns. We define the notion of total variation of the surface normal as a prior for this class of problems and discuss this term in the continuous and discrete settings. We also address a suitable numerical scheme to deal with the non-smoothness arising from the TV of the normal and present numerical results.

12:00-12:30

A data-driven approach to image denoising in X-ray computed tomography

Hyoung Suk Park National Institute for Mathematical Sciences
Jineon Baek National Institute for Mathematical Sciences, Korea
Sun Kyoung You Chungnam National University College of Medicine and Chungnam National University Hospital,Korea
Jae Kyu Choi Tongji University, China
Jin Keun Seo Yonsei University, Korea
Abstract: We propose a data-driven method for image denoising in X-ray computerized tomography (CT). The proposed method approximately estimates the Maximum a Posteriori, which can be expressed as minimizing the Kullback-Leibler divergence between data distribution and the distribution generated by the generative adversarial network. Prior information on target CT images can be incorporated from a data distribution. We performed numerical simulation and clinical experiments to show the validity of the proposed approach.

12:30-13:00

On localizing and concentrating electromagnetic fields

Yi-Hsuan Lin University of Jyvaskyla
Bastian Harrach
Hongyu Liu
Abstract: We consider field localizing and concentration of electromagnetic waves governed by the time-harmonic anisotropic Maxwell system in a bounded domain. It is shown that there always exist certain boundary inputs which can generate electromagnetic fields with energy localized/concentrated in a given subdomain while nearly vanishing in another given subdomain.

MS ME-1-2 9 11:00-13:00

Recent Advances in Applied Integrable Systems: Theory and Computations - Part 3

For Part 1 see: MS ME-1-2 7
For Part 2 see: MS ME-1-2 8
For Part 4 see: MS ME-1-2 10

Organizer: Kenichi Maruno Waseda University
Organizer: Anton Dzhamay University of Northern Colorado
Abstract: Recent advances in the applications of integrable systems extend to a wide range of mathematics and physical sciences, such as random matrices, cluster algebra and combinatorics, probability theory, numerical computations, cellular automata, tropical geometry and ultra-discrete systems, differential geometry, computer visualizations, nonlinear physics, and many others. The purpose of this mini-symposium is to bring together active researchers from across the world to discuss recent developments in various aspects of applied integrable systems.

11:00-11:30

Integrable evolutions of twisted polygons in centro-affine R^n

Annalisa Calini College of Charleston
Gloria Marí-Beffa University of Wisconsin-Madison
Abstract: This talk focuses on a natural geometric flow for polygons in centro-affine geometry derived from discretizations of the Adler-Gel'fand-Dikii flows for curves in projective space. We prove the compatibility of the two Hamiltonian structures in arbitrary dimension by lifting them to a pair of pre-symplectic forms on the moduli space of centro-affine arc length parametrized polygons. We also describe their kernels and discuss the integrability of the polygonal flows.

11:30-12:00

On mixed ultradiscrete soliton solution

Hidetomo Nagai Tokai university
Abstract: We propose a mixed ultradiscrete soliton solution. It includes two different types of soliton solutions. The equation and solution are derived from the generalized discrete BKP through ultradiscretization and reduced to the ultradiscrete KdV in a special case. We also discuss the time evolution rule for this equation.

12:00-12:30

Non-commutative continued fractions and KP maps

Adam Doliwa University of Warmia and Mazury
Abstract: Motivated by non-commutative KP maps we study continued fractions in non-commuting symbols. We present first several most pertinent analogs of results of the classical theory. Then we describe the KP maps from the point of view of the non-commutative analog of the Galois theorem on periodic continued fractions.

12:30-13:00

An expression of lambda determinant derived from Toda lattice equation

Yasuhiro Ohta Kobe University
Abstract: The lambda determinant is expressed in the form of usual determinant by using the Casorati determinant representation of the solution for two-dimensional discrete Toda lattice equation. The recursive definition of the lambda determinant is reduced to the two-dimensional discrete Toda lattice equation through gauge transformation.

MS A3-2-3 9 11:00-13:00

Multi-scale modeling and simulation in metal forming - Part 1

For Part 2 see: MS A3-2-3 10

Organizer: Dirk Roose KU Leuven - Dept. Computer Science
Organizer: Axel Klawonn Universität zu Köln

MS (co-)organized by the GAMM activity group "Computational Science and Engineering" (CSE)

Abstract: Simulation nowadays plays an important role in the design and implementation of metal forming operations. During sheet metal forming and forging, the mechanical properties of the material evolve, in a heterogeneous way, due to the evolution in microstructure and crystal orientation. Hence physics-based or phenomenological material models at all levels must be coupled to achieve accurate simulations at the macroscopic level. This also requires novel numerical methods, high performance computing, and parallel scalable algorithms. This mini-symposium will give an overview of ongoing research in Europe. Emphasis lies on modeling issues, accurate numerical methods, scalable algorithms, efficient software and validation.

11:00-11:30

Multi-scale modelling of sheet metal forming: From the atom to the component scale

Fengbo Han
Franz Roters Max-Planck-Institut für Eisenforschung
Dierk Raabe Max-Planck-Institut für Eisenforschung
Martin Diehl Max-Planck-Institut für Eisenforschung
Abstract: The average response of metallic materials is to a large extend determined by their crystallographic texture. In the case of multiphase materials, e.g. dual phase steels, the properties of the additional phases (e.g. strength, spatial distribution, and volume fraction) are similarly important. We present here a two-scale simulation approach using a spectral method based solver to directly incorporate above mentioned microstructural details in to component scale simulations.

11:30-12:00

Coupled multiscale modeling for hot forging of Ni and Ti alloys

Olga Bylya University of Strathclyde
Abstract: Modeling of hot forging is well matured. However, proper constitutive modeling is still a challenge. Real industrial forgings involve more complex thermo-mechanical history and sometimes extremely large deformations, which cannot be properly represented in laboratory tests, used for development and calibration of a majority of visco-plastic models. This paper presents a possible approach of a coupled

Javier De Frutos Baraja — University of Valladolid

Abstract: This work concerns the numerical solution of the finite-horizon Optimal Investment problem with transaction costs under Potential Utility, where an evolutive HJB equation with gradient constraints has to be solved. The reformulation of the problem as a non-linear parabolic double obstacle problem and the employment of polar coordinates allows to pose the problem in one spatial variable in a finite domain, avoiding many technical difficulties. The proposed spectral numerical method becomes very efficient.

CP FT-1-8 9 3 — **11:40-12:00**

Real option with the regime-switching jump-diffusion model on finite time horizon

Sunju Lee — Chungnam National University
Younhee Lee — Chungnam National University

Abstract: A real option under regime-switching jump-diffusion models is considered on finite time horizon. When an underlying cash flow follows a regime-switching jump-diffusion model, the purpose of the investor is to determine an optimal investment time to maximize the discounted expectation of a payoff function. The objective function and the optimal investment time are concerned with a Hamilton-Jacobi-Bellman problem. Numerical simulations are performed to analyze the various phenomena of the real option with regime-switching processes.

CP FT-1-8 9 4 — **12:00-12:20**

Evaluation of equity-based debt obligations

Alexander Fromm — University of Jena

Abstract: We consider a class of participation rights, i.e. obligations issued by a company to investors who are interested in performance-based compensation. Albeit having desirable economic properties equity-based debt obligations pose challenges in accounting and contract pricing. We formulate and solve the associated mathematical problem in a discrete time, as well as a continuous time setting. In the latter case the problem is reduced to a forward-backward system and solved using the method of decoupling fields.

CP FT-1-8 9 5 — **12:20-12:40**

Expected exponential utility maximization problem for bitcoin mining companies

Kazuhiro Yasuda — Hosei university

Abstract: In this talk, we consider an expected utility maximization problem for bitcoin mining companies with the exponential utility. The wealth process of the mining company is defined as the sum of profit and loss from the mining and trading in the bitcoin market. Here we assume that the bitcoin price process follows the Black-Scholes model. We obtain the explicit expression of the value function and the optimal trading strategy.

CP FT-1-8 9 6 — **12:40-13:00**

Testing of Binary Regime Switching Models using Squeeze Duration Analysis

Milan Kumar Das — IISER Pune
Anindya Goswami — IISER Pune

Abstract: We have developed a statistical technique to test the model assumption of binary-regime switching extension of the geometric Brownian motion (GBM) model by proposing a new discriminating statistics. Given a time series data, by performing several systematic experiments, we have successfully shown that the sampling distribution of the test statistics differs drastically if the model assumption changes from GBM to Markov-modulated-GBM, or to semi-Markov-modulated-GBM. Furthermore, we tested the regime switching hypothesis with Indian sectoral indices.

MS ME-1-2 10 — **14:30-16:30**

Recent Advances in Applied Integrable Systems: Theory and Computations - Part 4

For Part 1 see: MS ME-1-2 7
For Part 2 see: MS ME-1-2 8
For Part 3 see: MS ME-1-2 9

Organizer: Kenichi Maruno — Waseda University
Organizer: Anton Dzhamay — University of Northern Colorado

Abstract: Recent advances in the applications of integrable systems extend to a wide range of mathematics and physical sciences, such as random matrices, cluster algebra and combinatorics, probability theory, numerical computations, cellular automata, tropical geometry and ultra-discrete systems, differential geometry, computer visualizations, nonlinear physics, and many others. The purpose of this mini-symposium is to bring together active researchers from across the world to discuss recent developments in various aspects of applied integrable systems.

14:30-15:00

Asymptotic analysis of probabilistic cellular automata utilizing GKZ hypergeometric function

Kazushige Endo — Waseda University

Abstract: Probabilistic Burgers Cellular Automaton (PBCA) is equivalent to parallel updated Totally Asymmetric Simple Exclusion Process (TASEP). In this presentation, utilizing transition matrices and primitive combinatorial methods, we propose some conjectures for asymptotic distribution of PBCA and derive Fundamental Diagram (FD) which shows relations between density and mean flow of particles by the conjectures. Moreover, we show FD is some kind of GKZ hypergeometric functions and derive FD for infinite lattice utilizing GKZ hypergeometric functions.

15:00-15:30

Algebraic entropy and chaos in cluster algebras

Atsushi Nobe — Chiba University
Junta Matsukidaira Professor — Ryukoku University

Abstract: Integrability of a one-parameter family of second order nonlinear difference equations, each of which is arising from seed mutations of a rank 2 cluster algebra, is discussed. Four members of the family posses integrable structure, while the remining infinitely-many members do not. In order to evaluate their dynamics, algebraic entropy of the birational maps equivalent to the difference equations are explicitly computed via initial value problems to second order linear difference equations.

15:30-16:00

Integrability aspects of consistent systems of difference equations

Pavlos Xenitidis — Liverpool Hope University

Abstract: Consistent systems of difference equations constitute an interesting and delicate generalization of quad equations. They involve only one dependent variable and are composed of two or more higher order equations which are compatible with each other. In this talk we will discuss some properties of such systems and define their integrability. Moreover we will construct two hierarchies of consistent systems and establish their integrability by deriving their lowest order symmetries.

16:00-16:30

Integrable discretizations of the complex WKI equation and vortex filaments

Kenichi Maruno — Waseda University
Satomi Nakamura — Waseda University
Shinya Kido — Waseda University

Abstract: We consider integrable discretizationsof some integrable systems such as the mKdV equation and the complex WKI equation based on geometric approach (the correspondence between integrable systems and motion of space curves). We also show that the complex WKI equation describes the motion of a vortex filament. We perform numerical computations of a vortex filament by using the discrete complex WKI equation.

MS FT-2-4 10 — **14:30-16:30**

Reduced Order Modeling for Parametric CFD Problems - Part 4

For Part 1 see: MS FT-2-4 7
For Part 2 see: MS FT-2-4 8
For Part 3 see: MS FT-2-4 9

Organizer: Annalisa Quaini — University of Houston
Organizer: Yanlai Chen — University of Massachusetts, Dartmouth
Organizer: Gianluigi Rozza — SISSA, International School for Advanced Studies Trieste

MS Organized by: SIAG/CSE

Abstract: Large-scale computing is recurrent in several contexts such as fluid dynamics, due to the high computational complexity in solving parametric and/or stochastic systems. This often leads to an unaffordable computational burden, especially when dealing with real-world applications, real-time or multi-query computing. In order to lessen this computational burden, reduced-order modeling (ROM) techniques play a crucial role: they aim to capture the most important features of the problem at hand without giving up accuracy. This minisymposium

seamlessly from serial to multi-threaded shared-memory and multi-node distributed-memory executors.

18:00-18:30

Derivative-Free Robust Data-Fitting via Nonsmooth, Nonconvex Formulations

Matt Menickelly — Argonne National Laboratory
Stefan Wild — Argonne National Laboratory

Abstract: In data-driven optimization, it is sometimes the case that a subset of data is contaminated with outliers. In simulation-based optimization, not all runs of a simulation may produce reliable or useful output. I will discuss a novel method for learning least trimmed estimators, a robust variant of the SAA problems that arise in empirical risk minimization. This results in a particular nonsmooth nonconvex formulation of an optimization problem amenable to methods of (derivative-free) manifold sampling.

18:30-19:00

Improving flexibility, robustness and scalability of model-based derivative free methods

Coralia Cartis — Oxford University
Lindon Roberts — University of Oxford
Jan Fiala — NAG
Benjamin Marteau — NAG

Abstract: We present two software packages for derivative-free optimization (DFO): DFO-LS for nonlinear least-squares problems and Py-BOBYQA for general objectives. They employ model-based trust region methods, with efficient restarting mechanisms to deal with stagnation effects due to noise. We also discuss how to scale up these methods.

MS ME-1-9 1 — **17:00-19:00**

Integrable systems and discrete dynamics - Part 1

For Part 2 see: MS ME-1-9 2

Organizer: Giorgio Gubbiotti — The University of Sydney
Organizer: Nalini Joshi — The University of Sydney
Organizer: David Gomez-Ullate Oteiza — Universidad Complutense de Madrid
Organizer: Nobutaka Nakazono — Aoyama Gakuin University

Abstract: There has been increasing interest in integrable systems in the last two decades, particularly due to the appearance of Painlevé equations in random matrix theory and the theory of orthogonal polynomials. In this mini-symposium, we bring together three important perspectives: geometric and algebraic aspects of integrable systems, discrete differential geometry and the theory of orthogonal polynomials. We expect that the mini-symposium will create connections across the boundaries of these fields.

17:00-17:30

Rational solutions to higher order Painlevé equations. Part I: characterization.

David Gomez-Ullate Oteiza — Universidad Complutense de Madrid

Abstract: We prove that all rational solutions to the A2k Painlevé system (a.k.a. Noumi-Yamada system) belong to the class of rational extensions of the harmonic oscillator, and are thus expressible as Wronskian determinants whose entries are Hermite polynomials.

17:30-18:00

Discrete integrable systems generated by Hermite-Padé approximants

Walter Van Assche — KU Leuven
Alexander Aptekarev — Keldysh Institute of Applied Mathematics, Moscow
Maxim Derevyagin — University of Connecticut, USA

Abstract: We consider Hermite-Padx approximants in the framework of discrete integrable systems defined on the lattice Z^2. We show that the concept of multiple orthogonality is intimately related to the Lax representations for the entries of the nearest neighbor recurrence relations and it thus gives rise to a discrete integrable system. We show that the converse statement is also true. As an application, a class of cross-shaped difference operators on a two-dimensional (2D) lattice is introduced.

18:00-18:30

Miquel dynamics on circle patterns and the dimer model

Sanjay Ramassamy — École normale supérieure
Richard Kenyon — Brown University
Wai Yeung Lam — Brown University
Marianna Russkikh — University of Geneva

Abstract: Circle patterns are a way to draw a graph in the plane such that every face is cyclic. Miquel dynamics is a discrete-time dynamical system on circle patterns defined by using the classical Miquel six-circles theorem. Its integrability is obtained by establishing a novel connection between circle patterns and the dimer model from statistical mechanics. Joint work with Richard Kenyon (Brown University), Wai Yeung Lam (Brown University) and Marianna Russkikh (University of Geneva).

18:30-19:00

Spatial pattern of ultradiscretizable discrete Gray-Scott model and Turing instabilities of its equilibrium solutions

Keisuke Matsuya — Musashino University
Mikio Murata Professor — Tokyo University of Agriculture and Technology, Tokyo

Abstract: Ultradiscretization is a limiting procedure transforming a given difference equation into a cellular automaton. In this talk, we propose a discretization and an ultradiscretization of Gray-Scott model which is a reaction-diffusion system and whose solutions give various spatial patterns. The ultradiscrete system is directly related to the elementary cellular automaton Rule 90 which gives a Sierpinski gasket pattern. We also discuss relation between spatial patterns of the discrete system and Turing instability.

MS A3-2-2 1 — **17:00-19:00**

Mapping and managing hazards using Precursory Data, and Analysis

Organizer: E. Bruce Pitman — Univ at Buffalo
Organizer: Abani Patra — Univ at Buffalo

MS Organized by: SIAG/CSE

Abstract: The mitigation of hazard entails a end-to-end use of data, models and analysis. Precursory signals for are used to set alerts. Forecasts of event timing and magnitude building on the data and information in these signals (seismic, wind, acoustic, deformation etc.) are thus critical. However, many challenges associated with the poorly defined causality relationships between event and signal and the noisy data and lack of knowledge of physical processes leads to much uncertainty.

17:00-17:30

A SDE Framework for Material Failure

E. Bruce Pitman — Univ at Buffalo

Abstract: We introduce a stochastic model for studying material failure. The method extends the ideas of a simple but well-studied Failure Forecast Model (FFM) due to Voight and others, adding a stochastic forcing and a relaxation effect. Together these additions may be viewed as a characterization of “model uncertainty”, enabling prediction – together with confidence bounds – in spite of the FFM not capturing all the relevant physics.

17:30-18:00

A SDE Framework for Volcanic Precursors, Mapping and managing hazards using Precursory Data, and Analysis

Andrea Bevilacqua Bevilacqua — INGV

Abstract: We present two models using precursory information in the production of volcanic eruption forecasts. The first model enhances the well-established failure forecast method introducing an SDE in its formulation. The second model establishes a simple method to update prior spatial maps. The prior reproduce the two-dimensional distribution of past activity with a Gaussian Field. The likelihood relies on a one-dimensional variable characterizing the chance of material failure locally, based on the horizontal ground deformation.

18:00-18:30

Forecasting volcanic hazards with uncertainty: is it over? is it safe?

Elaine Spiller — Marquette University

Abstract: Communities situated near volcanos are often faced with intermittent threats as volcanic activity levels cycle on and off over years-decades. Unfortunately even if a volcano seems to have quieted, threats of a massive landslide from domes collapsing remains very real. We present hazard threat models for such low frequency, high consequence events. Further we produce emulator-based probabilistic hazard maps for civil authorities to understand the impact of model choices and uncertainties on hazard forecasts.

Abstract: We present results concerning thermodynamic underpinnings and PDE analysis for viscoelastic rate type fluids with/without stress diffusion. In particular, we state the results regarding long-time and large-data existence of solutions and the stability analysis. Attention is devoted to models in a full thermomechanical setting where energy transfer mechanisms are fully characterized, and where the specific forms of energy, entropy and entropy production lead to suitable a priori estimates and Lyapunov functionals.

11:30-12:00

Numerical simulation techniques for flows with complex rheology

Patrick Westervoß TU Dortmund
Stefan Turek TU Dortmund

Abstract: In viscoelastic fluids, described by differential or integral models, additional numerical challenges besides the well-known HWNP arise for negligible or vanishing solvent part. This "no solvent"-case requires numerically special care, particularly w.r.t. the involved solution methods, i.e. operator-splitting or fully monolithic approaches. In this talk, we present the new "Tensor Diffusion"-approach modelling the velocity-stress coupling via a tensor diffusion. We motivate this approach via several examples and present preliminary computational results for prototypical test configurations.

12:00-12:30

Thermodynamics of two-phase granular fluids

Vladimir Shelukhin Lavrentyev Institute of Hydrodynamics

Abstract: Starting from basic thermodynamic principles, we derive equations for a two-phase granular fluid. The phases differ in velocities, densities and viscosities. The first phase is described with the use of notion of the Cosserat continuum. To illustrate the model, we study how rotation of particles impacts their lateral migration in pipe and channel flows. We explain the Boycott effect and the tubular pinch effect of Ségre-Silberberg. We address anisotropic fluid flows for rod-shaped particles.

12:30-13:00

Finite-energy solutions for compressible two-fluid Stokes system

Ewelina Zatorska University College London
Didier Bresch
Piotr Mucha

Abstract: I will present the recent developments in the topic of existence of solutions to the two-fluid systems. A particular example of such a model is two-fluids Stokes system with single velocity field and two densities, and with an algebraic pressure law closure. The existence result uses the compactness criterion introduced by D. Bresch and P.-E. Jabin and stability estimates for the transport equation by G. Crippa and C. DeLellis.

IM FT-2-3 2 **11:00-13:00**

Modeling, Simulation and Optimization in Electrical Engineering - Part 1

For Part 2 see: IM FT-2-3 3
For Part 3 see: IM FT-2-3 4

Organizer: Kurz Stefan Robert Bosch GmbH
Organizer: Nella Rotundo Weierstrass Institute for Applied Analysis
Organizer: M. Pilar Salgado Rodríguez Universidade de Santiago de Compostela

Abstract: Electrical engineering is an important technology for many recent societal and industrial developments. It includes the investigation and application of electricity, electronics, and electromagnetism. This mini symposium discusses mathematical challenges driven by industrial needs, which are related to classical and new emerging topics of applied mathematics and scientific computing. It is organized in the framework of ECMI's Special Interest Group on Modeling, Simulation and Optimization in Electrical Engineering. Its history goes back more than 20 years, where it was established as part of ECMI's endeavor to strengthen the ties between applied mathematics and the electrical industry.

11:00-11:30

Dual spline complex for structure preserving isogeometric methods

Vázquez Hernández Rafael EPFL
Annalisa Buffa Ecole Polytechnique Fédérale de Lausanne

Abstract: Structure preserving isogeometric methods are based on the construction of a de Rham complex of B-spline spaces, in a generalization of edge and face finite elements with higher continuity. In the present paper we develop a dual spline complex for isogeometric methods, that generalizes the dual finite element complex by baricentric refinement introduced by Buffa and Christiansen in 2007. The dual spline complex is much easier to construct, thanks to the tensor-product structure of B-splines.

11:30-12:00

Isogeometric BEM-FEM coupling for the simulation of electric machines

Elasmi Mehdi TU Darmstadt
Christoph Erath Department of Mathematics, Technische Universität Darmstadt
Stefan Kurz Centre for Computational Engineering and TEMF, Technische Universität Darmstadt

Abstract: For the simulation of electric machines, we consider an isogeometric BEM-FEM coupling, i.e., NURBS are utilised for the parametrisation of multi-patch domains, and B-splines as Ansatz functions, respectively. This method allows an exact geometry representation and facilitates the incorporation of movements. Besides, a volume discretisation of thin and/or unbounded domains is avoided, and the regularity of derived quantities such as forces and torques is not deteriorated after differentiations. Some numerical experiments are presented, too.

12:00-12:30

New applications of the mortar element method on composite meshes

Francesca Rapetti Universite Cote d'Azur

Abstract: The MEM on overlapping meshes have been determinant in several contexts, as eddy current non-destructive testing and free-boundary axisymmetric plasma equilibria. Two meshes can either fully or partially overlap. This approach gives the flexibility to deal with the free movement of one subdomain or to achieve easily higher order regularity while preserving accurate meshing of the geometry. The continuity of the numerical solution in the overlap is weakly enforced by a suitable L2 projection.

12:30-13:00

Applications of the Virtual Element Method to Electromagnetism

Alessandro Russo University of Milano-Bicocca
Lourenco Beirao Da Veiga University of Milano-Bicocca
Franco Brezzi IMATI CNR, Pavia, Italy
Luisa D. Marini IMATI CNR, Pavia, Italy

Abstract: In my talk I will present a survey of the applications of the Virtual Element Method to Magnetostatics developed so far.

MS ME-1-9 2 **11:00-13:00**

Integrable systems and discrete dynamics - Part 2

For Part 1 see: MS ME-1-9 1

Organizer: Giorgio Gubbiotti The University of Sydney
Organizer: Nalini Joshi The University of Sydney
Organizer: Nobutaka Nakazono Aoyama Gakuin University
Organizer: David Gomez-Ullate Oteiza Universidad Complutense de Madrid

Abstract: There has been increasing interest in integrable systems in the last two decades, particularly due to the appearance of Painlevé equations in random matrix theory and the theory of orthogonal polynomials. In this mini-symposium, we bring together three important perspectives: geometric and algebraic aspects of integrable systems, discrete differential geometry and the theory of orthogonal polynomials. We expect that the mini-symposium will create connections across the boundaries of these fields.

11:00-11:30

On the inverse problem of the discrete calculus of variations

Giorgio Gubbiotti The University of Sydney

Abstract: In this talk we present the solution of the inverse problem of Calculus of Variations for a scalar difference equation of arbitrary even order 2k, with $k > 1$. This solution is obtained through the introduction of a set of differential operators called annihilation operators. Using these operators we reduce the functional equation governing of existence of a Lagrangian to the solution of an overdetermined system of linear partial differential equations.

11:30-12:00

Coxeter groups and discrete integrable systems

Yang Shi — Flinders University

Abstract: We explore some unique properties of Coxeter groups in the context of discrete integrable sys- tems. In particular, we look at the applications of Normalizer theory of parabolic subgroups in the studies of discrete Painleve equations.

12:00-12:30

The discrete integrable systems associated with LU factorizations

Masato Shinjo — Doshisha University

Abstract: The Toda equation is well-known as famous soliton equation was originally developed as a mathematical model of nonlinear springs in the study of integrable systems. The Lax dynamics of Toda equation plays an important role in elucidating interesting relationships between matrix eigenvalues. A skillful discretization of Toda equation contributes to computing eigenvalues of tridiagonal matrices based on LU factorization. In this talk, we show the discretizations of extensions of Toda equation associated with LU factorization.

12:30-13:00

A generalisation of tau-functions for the elliptic difference Painleve equation of type E_8

Andrew Kels — SISSA
Masahito Yamazaki — IPMU

Abstract: I will present a generalisation of the ORG (Ohta-Ramani-Grammaticos) tau-functions that were recently given by Noumi, depending on an additional 8 independent discrete parameters taking values from the E_8 root lattice. Using elliptic hypergeometric sum/integrals, I will show how to construct hypergeometric solutions which are defined on an infinite sequence of parallel hyperplanes, where the restriction of the hypergeometric tau-function to each individual hyperplane is invariant under the action of the Weyl group of E_7.

IM FT-4-4 2 — 11:00-13:00

Industrial Math Problems Based on Big Data

Organizer: Hyun-Min Kim — Pusan National University

Abstract: In the age of the fourth industrial revolution, many industrial problems based on big data have emerged, such as risk assessment in finance, machine learning in stock classi?cation, etc. Due to the high dimensionality and the complexity or heterogeneity of the data from industrial problems, mathematical techniques are needed for data visualization and for the design of efficient algorithms to solve these problems. This minisymposium aims at bringing together people working in the field of industrial mathematics, coming both from “academy” and from “industry” to present current industrial problems, exchange ideas on encountered challenges and possible mathematical approaches.

11:00-11:30

A model for collaboration on big data between local industries and university math departments

Hyun-Min Kim — Pusan National University
Dawoon Jung — Pusan National University
Semin Oh — Pusan National University
Young-Jin Kim — Pusan National University
Jeong Rye Park — Pusan National University
Garam Kim — Pusan National University
Juneho Lee — Pusan National University

Abstract: In this talk, we will introduce industrial mathematics problems solved with the companies which are KOMAX (Special Printing Company), Animal and Plant Quarantine Agency, NFRDI, KHFC, and so on. Finally, we will consider the direction of research on industrial mathematics in Korea and how to promote exchanges with other areas in the future. Based on this, we want to investigate what kind of desirable roles and talents mathematics, which form the basis of Big Data.

11:30-12:00

An optimal route recommendation system for ships based on A* search algorithm

Taehyeong Kim — Pusan National University
Sangil Kim — Pusan National University
Giphil Cho — Pusan National University
YiCheng Hong — Pusan National University
Jie Meng — Pusan National University
SeungHeon Yi — Pusan National University
Geunsoo Jang — Pusan National University
Meiyan Jiang — Pusan National University
Seonguk Nam — Pusan National University

Abstract: In this study, an optimal route recommendation algorithm for ships has been developed with the starting and ending information of time and locations. The algorithm calculates optimal route considering various data such as marine climate and weather forecast from Copernicus and ECMWF. We employ A* search algorithm with weight depended on the data we obtained. Our numerical results are compared with the actual route of a ship.

12:00-12:30

Analysis of the Interictal and Ictal Pattern Dynamics from EEG Data by Dynamic Mode Decomposition

Jonghyeon Seo — Chubu University Academy of Emerging Sciences
Jong-Hyeon Seo — Chubu University / Academy of Emerging Science

Abstract: There have been many studies to interpret the brain dynamics from the viewpoint of nonlinear dynamical systems. Especially, the studies using the analysis tools have been attempted to reliably detect epileptic seizures. In this work, we investigate the possibility of predicting epileptic seizers by applying dynamic mode decomposition, an algorithm originally developed for studying fluid physics, to neural recording samples.

12:30-13:00

Prediction of credit card delinquency using Machine Learning

Shin Won Yun — Pusan National University
Seong Uk Nam — Pusan National University
Hyun Chae — Busan Bank
Suk Kyo Ko — Busan Bank

Abstract: The purpose of this study is to predict the delinquent over 30 days of credit card customers using machine learning methods. Drawing from a one-year dataset(September 2017 to August 2018) from Bank B, Korea, researchers identied signicant variables for the purpose of delinquent forecast. Classication Techniques in Machine Learning was adopted to compare the performance of each model for this study: 1) Logistic Regression, 2) Neural Network, 3) Random Forest, and 4) Gradient Boosting.

MS FT-2-4 2 — 11:00-13:00

New trends in dimensionality reduction of parametrized and stochastic PDEs - Part 2

For Part 1 see: MS FT-2-4 1

Organizer: Andrea Manzoni — POLITECNICO DI MILANO - LABORATORIO MOX -
Organizer: Fabio Nobile — EPFL SB MATH CSQI

Abstract: Model reduction is an indispensable tool for simulation-based science, whenever multiple or real-time simulations are performed. Reduced order models (ROMs), such as the reduced basis method, and approximate response function techniques, such as sparse polynomial chaos expansions, kernel approximations, Gaussian process regression, provide efficient strategies to tackle parametrized or stochastic PDEs. Nonlinear dimensionality reduction techniques, such as local ROMs, manifold learning or machine learning, can provide new valuable tools to approximate the whole solution set of problems hardly reducible with current state-of-art methods. However, their use for predicting system outcomes in new scenarios is at the moment rather involved.

11:00-11:30

Adaptive multi-scale methods for machine learning

Stefano Vigogna — Universita' degli Studi di Genova

Abstract: We describe learning techniques based on processing data in a coarse to fine fashion, to adaptively achieve a desired accuracy level. The methods we consider can be seen as an extension of wavelet methods beyond regular domains. On the other hand, they draw inspiration from classical decision trees beyond vectorial data. The properties of the proposed methods are analyzed within a statistical learning framework and characterized in terms of finite sample bounds in high probability.

11:30-12:00

Parametric Model Reduction based on Shifted POD Modes

Schulze Philipp — TU Berlin

Abstract: In this talk we address model reduction of systems whose dynamics are dominated by the advection of high-gradient structures,