Brandenburg University of Technology Cottbus - Senftenberg

EUNICE EUROPEAN UNIVERSITY

1ST EUNICE–SYMPOSIUM ON PURE & APPLIED MATHEMATICS 2021

Cottbus

July 7, 2021

Welcome to the 1st EUNICE–Symposium on Pure & Applied Mathematics 2021

Dear Participants,

on behalf of the whole organizing committee, we would like to welcome you to the 1st EUNICE–Symposium in Cottbus. We have received a wealth of abstracts from a wide variety of mathematical disciplines which will give a good overview on the research of the participating universities.

Each institution has been given a time slot of 90 minutes. The first talk within each slot is designated to an overview talk that gives an impression of the university and its surroundings as well as the various fields of mathematics that are covered. After the first introductory plenary talk, the audience will split into parallel sessions of more technical talks on specific research areas. The last session of the day will be held by the international offices which will give us an overview of existing funding programs for collaborations. There will also be time for an immediate feedback on the symposium.

We would like to thank all the presenters who submitted their work and we hope that this symposium will lead to many fruitful collaborations.

Ekkehard Köhler, Mareike Kunze, Jesse Beisegel and Armin Fügenschuh

Contact Information

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Organizational Details

This Symposium will take place using the video conferencing system Cisco WebEx Meetings. This tool can be used directly in the browser or with the free WebEx Meetings Application. In the digital version of this program all meeting rooms can be accessed via hyperlinks (marked by ⧉) in the schedule. Alternatively, you can also access all rooms via the following links or with the Meeting-ID. In order to join a conference room, you will have to enter the matching passcode from the list below.

- **Plenary**:
  https://b-tu.webex.com/b-tu/j.php?MTID=m43bac4fc55ac3f7ad65f50e47073cdbc
  Meeting-ID: 121 573 7930
  Passcode: VBeF4Nnmk66
- **Room A**:
  https://b-tu.webex.com/b-tu/j.php?MTID=m8fc626b9f243c60fe2e58663acdc8d3a
  Meeting-ID: 121 556 7190
  Passcode: XajBa8pHW43
- **Room B**:
  https://b-tu.webex.com/b-tu/j.php?MTID=m648a5527d602ce82c703f58cb0c1e6b3
  Meeting-ID: 121 357 2159
  Passcode: MdMUDMsM866
- **Room C**:
  https://b-tu.webex.com/b-tu/j.php?MTID=m4d9f6f9a7da19c2418937e847bb5f26f
  Meeting-ID: 121 930 4292
  Passcode: XXqMuUKM359
- **Room D**:
  https://b-tu.webex.com/b-tu/j.php?MTID=mc96e7164b5c502823880e3d52d6443e0
  Meeting-ID: 121 547 6160
  Passcode: j3sUY4stTY4

08:00 – 08:15	Welcome			
08:15 – 08:40	**Brandenburg University of Technology, Cottbus, Germany:** Ekkehard Köhler			
Session 1	Room A	Room B	Room C	Room D
08:45 – 09:10	**Computational Stochastics: from black swans to falling cats** Carsten Hartmann	**Optimal control of PDEs with nonsmooth aspects** Gerd Wachsmuth	**The lattice of cycles of an undirected graph** Gennadiy Averkov	**Technical Applications of Operations Research Methods** Armin Fügenschuh
09:15 – 09:40	**Stochastic Optimal Control & Decisions Under Uncertainty** Ralf Wunderlich	**Weighted functional spaces approach to nonlinear infinite horizon optimal control problems: stabilization, numerical analysis, bio-medical applications.** Valeriya Lykina	**Network optimization and efficient graph algorithms** Ekkehard Köhler	
09:45 – 10:00	**Coffee Break**			
10:00 – 10:25	**University of Cantabria, Santander, Spain:** Mario Fioravanti			
Session 2	Room A	Room B	Room C	Room D
10:30 – 10:55	**Optimal Control of Partial Differential Equations** Eduardo Casas	**The search for minimal energy points** Carlos Beltrán	**Polytopes: algebra, combinatorics and computation.** Francisco Santos	
11:00 – 11:25	**A spectral homogenization problem with high contrasts on the boundary conditions** María-Eugenia Pérez-Martínez	**Interfaces in incompressible fluids** Rafael Granero-Belinchón	**Symbolic computation, algebraic and tropical geometry** Luis Felipe Tabera	
11:30 – 12:30	**Lunch Break**			
12:30 – 12:55	**University of Catania, Italy:** Orazio Muscato			
Session 3	Room A	Room B	Room C	Room D
13:00 – 13:25	**Recent trends in computable set theory** Domenico Cantone	**Partial Differential Equations under minimal assumptions** Giuseppe Di Fazio	**Multimedia Forensics: from JPEG compression analysis to Deepfake detection** Luca Guarnera	**Deep Learning technologies for automotive** Roberto Leotta
13:30 – 13:55	**A Gentle Introduction to Functional Encryption** Dario Catalano	**Combinatorics and Geometry towards applications** Elena Guardo	**Morrey estimates for some classes of elliptic equations with a lower order term** Salvatore Leonardi	**Design Metaheuristics for Complex Networks** Mario F. Pavone
14:00 – 14:15	**Coffee Break**			
14:15 – 14:40	**University of Mons, Belgium:** Quentin Menet			
Session 4	Room A	Room B	Room C	Room D (Catania)
14:45 – 15:10	**Constrained Low-Rank Matrix Approximations** Nicolas Gillis	**Using Graph Theory to Derive Inequalities for the Bell Numbers** Hadrien Mélot		**Deep Learning for Medical diagnostic and Microscope Imaging** Francesca Trenta
15:15 – 15:40	**Linear dynamics** Quentin Menet	**Statistical Learning Theory** Xavier Siebert		**Mathematics for Technology** Vittorio Romano
15:45 – 16:00	**Coffee Break**			
16:00 – 16:05	**Polytechnic University of Hauts-de-France, Valenciennes, France:** VP Recherche			
16:05 – 16:15	**LAMAV Polytechnic University of Hauts-de-France:** Serge Nicaise			
16:15 – 16:25	**LMI Polytechnic University of Hauts-de-France:** Luc Vrancken			
Session 5	Room A	Room B	Room C	Room D
16:30 – 16:55	**“Fighting with numbers” in the Middle Ages and nowadays** François Goichot	**Decay rate for the Timoshenko system with one boundary damping** Virginie Régnier	**Spectral analysis of a generalized buckling problem on balls & A computer assisted proof of the symmetries of least energy sign changing solutions** Colette De Coster & Christophe Troestler	
17:00 – 17:25	**Maximal abelian varieties over finite fields and cyclicity** Alejandro Giangreco Maidana	**A free boundary model describing corrosion process** Juliette Venel		
17:30 – 18:25	**Program-Presentation & Discussion: The Way Ahead**			
18:25 – 18:30	**Farewell**			

ROOM A 08:45–09:10

Computational Stochastics: from black swans to falling cats

Carsten Hartmann

I will give a brief and high-level overview of some computational problems in stochastics and explain where stochastic analysis and control theory can help to make the numerical simulation of complex dynamical systems more efficient. Specifically, I will discuss some challenges related to the simulation of multiscale diffusions that appear, for example, in molecular dynamics or climate modelling. In the talk I will focus on three prototypical examples: (a) rare event simulation using adaptive importance sampling, (b) model reduction of high-dimensional parametric differential equations, (c) optimal prediction of molecular systems.

ROOM B 08:45–09:10

Optimal control of PDEs with nonsmooth aspects

Gerd Wachsmuth

In this talk we consider the optimal control of partial differential equations (PDEs). That is, we minimize an objective depending on a state and on a control. The state is given by the solution of a PDE in which the control appears as a parameter (typically as the right-hand side). The nonsmoothness may appear directly in the objective (i.e. via a nonsmooth regularization term such as an L^1 norm or the total variation norm norm), or in the state equation (i.e., a variational inequality such as the obstacle problem). We are interested in optimality conditions, numerical realization and numerical analysis.

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ROOM C 08:45–09:10

The lattice of cycles of an undirected graph

Gennadiy Averkov, Anastasia Chavez, Jesus De Loera and Bryan Gillespie

Encoding combinatorial structures through finite subsets of vectors spaces (say, in terms of characteristic vectors) is a fundamental approach in combinatorial optimization. I am going to talk about a variation on the classical topic of cycle bases. As everyone knows, in a directed graph, the undirected cycles can be encoded as -1/0/1 characteristic vectors. This leads to the classical cycle spaces and cycle bases, which are important objects in network optimization. What about 0/1 characteristic vectors of cycles in UNDIRECTED graphs? I will present results about the vector space and the lattice generated by such vectors. This is joint work with Anastasia Chavez, Jesus De Loera and Bryan Gillespie.

ROOM D 08:45–09:10

Technical Applications of Operations Research Methods

Armin Fügenschuh

At the professorship “Engineering Mathematics and Numerics of Optimization” (head: Prof. Fügenschuh), five research associates are currently working on engineering applications of mathematical optimization methods. Both exact and heuristic methods are used to solve difficult optimization problems related to real-world applications. The focus is on enumerative branch-and-bound methods, in which mixed-integer optimization problems are first relaxed linearly and improved by cutting planes. Current applications include flight route planning for drones, sequence planning for wire-arc additive manufacturing and powder-bed selective laser melting. Simulation methods are also used, for example in the deployment planning of autonomous underwater vehicles and the analysis of emergency rescue chains.

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ROOM A 09:15–09:40

Stochastic Optimal Control & Decisions Under Uncertainty

Ralf Wunderlich

We review some current research projects where stochastic optimal control problems arise in the mathematical modeling of dynamic decision making problems under uncertainty. Examples are cost optimal management of energy storages, portfolio optimization and optimal containment of epidemics.
We mainly work with continuous-time models in which the dynamics of the controlled state is described by systems by stochastic, ordinary and partial differential equations. Further, we consider partially observable control systems and apply filtering theory. The control problems are solved using dynamic programming leading to Hamilton-Jacobi-Bellman equations which have to be solved numerically.

ROOM B 09:15–09:40

Weighted functional spaces approach to nonlinear infinite horizon optimal control problems: stabilization, numerical analysis, bio-medical applications.

Valeriya Lykina and Sabine Pickenhain

Currently in our group bio-medical models are formulated and treated as infinite horizon optimal control problems (IHOCP's). The incorporation of an unbounded planing horizon represents an important and challenging mathematical issue which has been proved to be a proper idealization for sustainability principle so much targeted by the society. Our fundamental research goals cover both theoretical aspects of solving (IHOCP's) and development of suitable numerical solution methods for the mentioned class of problems. Derivation, proof of necessary and sufficient optimality conditions as well as of existence results happens within the framework of weighted functional spaces setting.

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ROOM C 09:15–09:40

Network optimization and efficient graph algorithms

Ekkehard Köhler

In our group we are working mainly in two areas. On the one hand we glook at problems from network optimization with special focus on network flow problems. In particular we consider time dependent flow problems and their application in traffic networks. There, we look at game theoretic models for traffic flows in various settings. A typical application of our research is the optimization of traffic light networks.
On the other hand, we study efficient graph algorithms for special graph classes. Right now we are especially interested in properties of various search algorithms, like variants of breadth-first-search and depth-first-search. Although these algorithms have been known for a long time and they are applied in many contexts, not much is known about their inherent structural properties. A simple question like whether a certain vertex of a given graph can be the end-vertex of a such a search is already quite difficult to answer.
In this talk we will give a short overview over some research problems from these two areas and we will mention some of the applications that we have worked on.

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ROOM A 10:30–10:55

Optimal Control of Partial Differential Equations

Eduardo Casas

This talk deals with a class of optimal control problems for semilinear parabolic equations subject to control constraint of the form $\|u(t)\|_{L^1(\Omega)} \leq \gamma$ for every $t \in (0, T)$. This limits the total force that can be applied to the system at any instant of time. Due to the non-smoothness of the constraint, the analysis of the control problem requires new techniques. Existence of a solution, first and second order optimality conditions, and regularity of the optimal control are proved.

ROOM B 10:30–10:55

The search for minimal energy points

Carlos Beltrán

A classical mathematical problem is describing the properties of collections of N points in some set such that some potential energy is minimized. One can think on N spherical points in the unit sphere with the classical electrostatic potential or the logarithmic energy. Finding these collections of points efficiently is the subject of the 7th problem in Smale's list. The question can be raised in compact manifolds, yielding a number of very interesting open problems of interest for the Approximation Theory and the Mathematical Physics community. We are also interested in relations to the conditioning of numerical problems.

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ROOM C 10:30–10:55

Polytopes: algebra, combinatorics and computation.

Francisco Santos

Polytopes are fundamental objects in geometric combinatorics, and have applications in algebraic geometry and optimization:
- in algebraic geometry, lattice polytopes (polytopes with all vertices integer) arise as Newton polytopes of polynomials.
- in optimization, polytopes arise as the feasibility regions of linear programs.
The Santander group on discrete geometry has done extensive research in these two (and other) aspects of polytope theory, constructing for example polytopes that violate the Hirsch conjecture (2012), or that have disconnected toric Hilbert schemes (2005). In the last years we have studied covering properties of polytopes, partially in collaboration with Gennadiy Averkov from BTU (another EUNICE member).

ROOM A 11:00–11:25

A spectral homogenization problem with high contrasts on the boundary conditions

María-Eugenia Pérez-Martínez

We consider a spectral homogenization problem for the Laplace operator posed in a bounded domain of the upper half-space, a part of its boundary being in contact with the plane. The boundary conditions in the plane alternate periodically from Dirichlet to Robin, in very small regions, and contain large parameters. We contrast formal methods with energy methods and highlight the role of the microscopic problems when obtaining convergence for solutions.

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ROOM B 11:00–11:25

Interfaces in incompressible fluids

Rafael Granero-Belinchón

In this talk I will review some results concerning several free boundary problems arising in fluid mechanics. In particular, we will consider the motion of surface waves in viscous fluids and the evolution of interfaces in porous media.

ROOM C 11:00–11:25

Symbolic computation, algebraic and tropical geometry

Luis Felipe Tabera

In this talk we will give an overview of several problems studied by our group. Such as derive algorithmic approaches to compute geometric loci from curves and surfaces: bisectors, offsets or medial-axis with a view towards applications in CAGD. We will also talk about some results concerning the tropical discriminant, purely tropical definitions of singular hypersurface or the combinatorics of the tropical discriminant.

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ROOM A 13:00–13:25

Recent trends in computable set theory

Domenico Cantone

In the last decades, the decision problem in set theory has been studied quite thoroughly, giving rise to the field of Computable Set Theory. The initial goal was the mechanical formalization of mathematics with a proof verifier based on the set-theoretic formalism, but soon a foundational interest aimed at the identification of the boundary in set theory between the decidable and the undecidable became more and more compelling. We review recent results about small fragments of set theory endowed with (nondeterministic) polynomial decision procedures and a positive solution to the long-standing open decision problem for the Hilbert's tenth problem-like language involving union, intersection, set difference, and the unordered Cartesian product.

ROOM B 13:00–13:25

Partial Differential Equations under minimal assumptions

Maria Stella Fanciullo, Giuseppe Di Fazio and Pietro Zamboni

Assumptions stated in many published results about PDEs are too restrictive for what is needed in applications. We are developing new methods that guarantee qualitative results under very simple and general assumptions. Mainly we study Morrey spaces and Stummel – Kato classes that are more natural and effective than other previously known in the literature. Applications Thanks to Morrey spaces we may consider equations containing very singular potentials that are more suitable with concrete applications. By using the technique developed for the Morrey spaces it is possible greatly improve previous results in the literature. Indeed, such techniques allow to consider potentials with low integrability and the case when the potential is a measure.

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ROOM C 13:00–13:25

Multimedia Forensics: from JPEG compression analysis to Deepfake detection

Sebastiano Battiato, Oliver Giudice, Francesco Guarnera and Luca Guarnera

Multimedia Forensics was born with the purpose of fighting cybercrimes on multimedia content created through the illicit use of digital tools, causing in many cases serious repercussions on people's lives, political problems and the spread of misinformation. In our labs we recently developed techniques to identify if a multimedia content was manipulated, analyzing anomalies into the DCT domain of JPEG compressed images. Also we investigated the intriguing world of Deepfakes exploiting synthetic data to find traces left by generative models that can be detected by analyzing the architectures of the involved neural engines.

ROOM D 13:00–13:25

Deep Learning technologies for automotive

Sebastiano Battiato, Roberto Leotta, Alessandro Ortis, Francesco Rundo and Francesca Trenta

The evolution of technologies in the automotive industry has led to the development of the so-called Advanced Driver Assistance Systems (ADAS). The IPLAB research group (Image Processing Laboratory), in collaboration with STMicroelectronics, has developed new workflows with the aim of improving these systems. Several pipelines have been designed in order to propose new approaches to achieve better results in different tasks. For instance, among the many designed systems, the authors developed one that can monitor road surface, one to track the driver's attention level based on the driving context, and a workflow to be able to run a neural network on embedded board.

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ROOM A 13:30–13:55

A Gentle Introduction to Functional Encryption

Dario Catalano

Functional Encryption is a novel form of encryption where the owner of a (master) secret key can generate “restricted" decryption keys sk_f that can be used to learn specific functions of the encrypted messages. Each sk_f is associated to a function f and using sk_f to decrypt $Enc(m)$ one gets $f(m)$, but no other information about m is leaked. In this talk we present a non technical introduction to this powerful primitive: we'll briefly discuss applications, constructions and variants. We will conclude the presentation with a short overview of some of the (many!) challenges that remain to address.

ROOM B 13:30–13:55

Combinatorics and Geometry towards applications

Elena Guardo

We study the connections between Algebraic Geometry/Commutative Algebra and Graph and Hypergraph Theory. We also study their applications to Coding Theory. In particular, we construct and study special configurations of points associated to Steiner Systems. We compute the parameters of the linear code associated to Steiner configurations. We find that the Waldschmidt constant of a squarefree monomial ideal I can be expressed as the optimal solution to a linear program constructed from the primary decomposition of I. We study extended bicolorings of Steiner triple systems (STS) which start with a k-bicoloring of an $STS(\nu)$ and end up with a k-bicoloring of an $STS(2\nu + 1)$ obtained by a doubling construction, using only the original colors used in coloring the subsystem $STS(\nu)$.

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ROOM C 13:30–13:55

Morrey estimates for some classes of elliptic equations with a lower order term

G. R. Cirmi, S. D'Asero and S. Leonardi

We will browse a series of results on elliptic equations and systems, with particular nonlinear lower order terms and measure right-hand side, obtained in the last years. Namely we take into account equations whose prototypes are:

$$-\Delta u + u|Du|^2 = f$$

or

$$-\Delta u + \frac{|Du|^2}{u^\theta} = f, \qquad \theta \in]0,1[,$$

where the right-hand side f belongs to a suitable Morrey space, for instance to $L^{1,\lambda}$, $0 < \lambda \leq N-2$, and we prove corresponding Morrey estimates for the gradient of a solution.

ROOM D 13:30–13:55

Design Metaheuristics for Complex Networks

Mario F. Pavone

Metaheuristics are successful techniques able to solve complex and hard optimization problems, which arise in any human activities, and constitute a highly diverse family of algorithms with different properties, and strengths. Today, they represent reliable methodologies on all those problems where classical methods fail, due to their hardness, uncertainties, and high number of information to handle. A metaheuristic based on the immune system simulation successfully applied on some complex networks problems will be described and analysed.

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ROOM D 14:45–15:10

Deep Learning for Medical diagnostic and Microscope Imaging

Sebastiano Battiato, Alessandro Ortis and Francesca Trenta

In the last few years, Computer Vision (CV) and Deep Learning (DL) methods have led to impressive performances on a variety of problems. Hence, IPLAB research group (Image Processing Laboratory) developed CV and DL approaches for microscopy image processing and medical image classification. IPLAB is part of the Department of Mathematics and Computer Science of the University of Catania, Italy. In these fields, we recently published a large-scale dataset of pollen grain images, we presented a paper at CVPR 2020 and one at ICIP 2020. Also, we organized the first Pollen Grain Classification Challenge in conjunction with the ICPR. Moreover, we designed advanced DL pipelines to perform effective image classification. We presented our findings at ICPR 2020 and published a paper in Journal of Imaging.

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ROOM D 15:15–15:40

Mathematics for Technology

Vittorio Romano

The Department of Mathematics and Computer Science (DMI) of the University of Catania hosts the Interdepartimental Center of Mathematics for Technology (CIMAT) "A.M. Anile". I have the pleasure to be the Director of such a Center which has been devised with the aim to bring together scientists of several applied sciences whose research activity needs the use of advanced Mathematics. Enhanced technological improvements require an in-depth scientific knowledge. In this respect, Mathematics can play a major role in the applied science and great potentialities are still to be fully exploited. The main fields of activities within CIMAT regards mathematical modeling for electron devices, including numerics and simulations, advanced scientific computing, mathematical problems for population dynamics, e.g. models for the spread of pandemics, optimization, applications of artificial intelligence and machine learning to technology design, e.g. integrated electric circuits. In the talk and overview of possible joint research activities having a strong focus on the applications will be outlined. More specifically, the group of applied mathematics at the DMI has a long expertise in the field of mathematical modeling and simulation of semiconductors. Hydrodynamical and energy transport models have been developed with the use of the Maximum Entropy Principle for the charge transport in Si, GaAs, SiC. For such models analytical studies have been performed and suitable numerical schemes have been formulated along with a suitable Monte Carlo procedure to take properly into account the exclusion Pauli principle in the degenerate case. The cases of charge transport in the presence of confinement, such as Double Gate MOSFETs, nano-wires, graphene, have been tackled as well. Moreover, UNICT has developed numerical schemes for the semiclassical Boltzmann equation, has improved techniques of Monte Carlo type for the Wigner equation and has investigated the problem to describe the effects of crystal heating by including the phonon transport as well. The unit of Catania has also got expertise in the application of group analysis for the determination of exact solutions for partial differential equations. At the end, we mention some conferences and schools related to the project that the UNICT group of applied mathematics has organized.

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ROOM A 14:45–15:10

Constrained Low-Rank Matrix Approximations

Nicolas Gillis

Given a matrix X, computing a rank-r approximation of X is a key problem and has many applications; in particular, in data analysis and machine learning. Using the standard least-squares error, the problem is equivalent to principal component analysis (PCA) and can be solved via the singular value decomposition. We introduce in this talk a more general class of problems, constrained low-rank matrix approximations, where additional constraints are taken into consideration to improve the decomposition. In particular, we present three widely used models, namely nonnegative matrix factorization, robust PCA, and PCA with missing data. We illustrate the use of these models on some applications in data analysis. Although these models lead to NP-hard problems, we present several practical cases when they can be solved efficiently.

ROOM B 14:45–15:10

Using Graph Theory to Derive Inequalities for the Bell Numbers

Hadrien Mélot

The Bell numbers count the number of different ways to partition a set of n elements while the graphical Bell numbers count the number of non-equivalent partitions of the vertex set of a graph into stable sets. This relation between graph theory and integer sequences has motivated us to study properties on the average number of colors in the non-equivalent colorings of a graph. This led to an approach allowing to discover new non trivial inequalities for the Bell numbers.

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ROOM A 15:15–15:40

Linear dynamics

Quentin Menet

Linear dynamics is the theory studying the dynamics of linear operators defined on Banach spaces or Fréchet spaces. Given a linear operator T defined on a space X, the study of the dynamics of T consists in investigating the properties of sets $\{T^n x : n \geq 0\}$ where x is an element of X. Such a set is called an orbit of T. For instance, a linear operator is said to be hypercyclic if it has a dense orbit. The existence of hypercyclic operators is known since 1929 when Birkhoff showed that the non-trivial translation operators on the space of entire functions are hypercyclic. Since then, many concepts have been introduced and have made linear dynamics a very active field. The goal of this talk will be to give you a quick overview of this research area and its open questions.

ROOM B 15:15–15:40

Statistical Learning Theory

Xavier Siebert

The overall aim of statistical learning theory is to study which "concepts" are learnable by a computer. In particular, statistical properties are established about the convergence of learning algorithms, usually expressed in terms of the number of data points required to reach a given level of accuracy. This presentation will highlight some of the main ingredients of statistical learning theory, such as the "Probably Approximatively Correct" (PAC) frame- work and concentration inequalities. It will also point to applications of this theory in the active learning framework, where the learner can interactively request labels at any point in the data space to accelerate learning.

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ROOM A 16:30–16:55

“Fighting with numbers” in the Middle Ages and nowadays

François Goichot

One of the themes of the PHA team is history of mathematics and its use in teaching mathematics. We intend to illustrate this by presenting rithmomachia. It is a sophisticated board game, created around 1030 to help learning arithmetics – in fact, arithmetics of these times, i.e. that of Boethius (ca 480 - 524). The game was still in use in the 16th century. We shall explain the main lines of Boethius' theory, and then survey the game, its rules and history. Some members of PHA have also begun to adapt rithmomachia to the pupils of today (aged 11-15 but also 9-11) ; we will present the current state of these experiments.

ROOM B 16:30–16:55

Decay rate for the Timoshenko system with one boundary damping

D. Mercier and V. Régnier

We study the indirect boundary stabilization of the Timoshenko system with only one dissipation law. This system, which models the dynamics of a beam, is a hyperbolic system with two wave speeds. Assuming that the wave speeds are equal, we prove exponential stability. Otherwise, we show that the decay rate is of exponential or polynomial type. Note that the results hold without the technical assumptions on the coefficients coming from the multiplier method: a sharp analysis of the behaviour of the resolvent operator along the imaginary axis is performed to avoid those artificial restrictions.

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ROOM C 16:30–16:55

A computer assisted proof of the symmetries of least energy sign changing solutions

A. Salort and Christophe Troestler

In this second short presentation, we will discuss the symmetries of sign-changing solutions with least energy to the Lane-Emden problem

$$\begin{cases} -\Delta u = |u|^{p-2}u & \text{in } \Omega, \\ u = 0 & \text{on } \partial\Omega, \end{cases}$$

set on a domain $\Omega \subseteq \mathbb{R}^N$, $N \geq 2$. In particular, we will present results in the near linear case ($p \approx 2$) when Ω is a square which rely on computer-assisted arguments.

ROOM C 16:30–16:55

Spectral analysis of a generalized buckling problem on balls

Colette De Coster, S. Nicaise and Christophe Troestler

In this first talk, we are interested in the following fourth order eigenvalue problem coming from the buckling of thin films on liquid substrates:

$$\begin{cases} \Delta^2 u + \nu u = -\lambda \Delta u & \text{in } B_1, \\ u = \partial_r u = 0 & \text{on } \partial B_1, \end{cases}$$

where B_1 is the unit ball of $\mathbb{R}^N$, $N \geq 2$. More precisely, we are interested in the multiplicity of the first eigenvalue and in the shape of the first eigenfunction as ν changes.

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ROOM A 17:00–17:25

Maximal abelian varieties over finite fields and cyclicity

E. Berardini and Alejandro Giangreco Maidana

In this work we establish a relation between totally positive algebraic integers with minimal trace, and maximal isogeny classes of simple abelian varieties defined over finite fields with cardinality an even power of a prime, and which have a field as endomorphism algebra. We show that there is an equivalence between knowing the Weil polynomial of such an isogeny class and the minimal polynomial of such algebraic integer. As a consequence, we obtain results about the cyclicity of the group of rational points of such abelian varieties.

ROOM B 17:00–17:25

A free boundary model describing corrosion process

Juliette Venel

In this work we propose a free boundary model to take into account corrosion process. Our model is in a way a simplification of a Diffusion-Poisson-Coupled-Model (DPCM). The last one allows to capture corrosion phenomena but its well-posedness is not still proved. Here we propose a toy model which is able to recover the enlargment of oxide layer. We kept the main mathematical difficulties namely the presence of a moving interface between the oxide layer and the metal. Besides another interface, which is supposed to be steady, allows us to model the exchanges between the oxide layer and the solution. During my talk, I will introduce this toy model. Then I will develop a gradient-flow framework based on the Wasserstein metric in order to prove existence results.

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