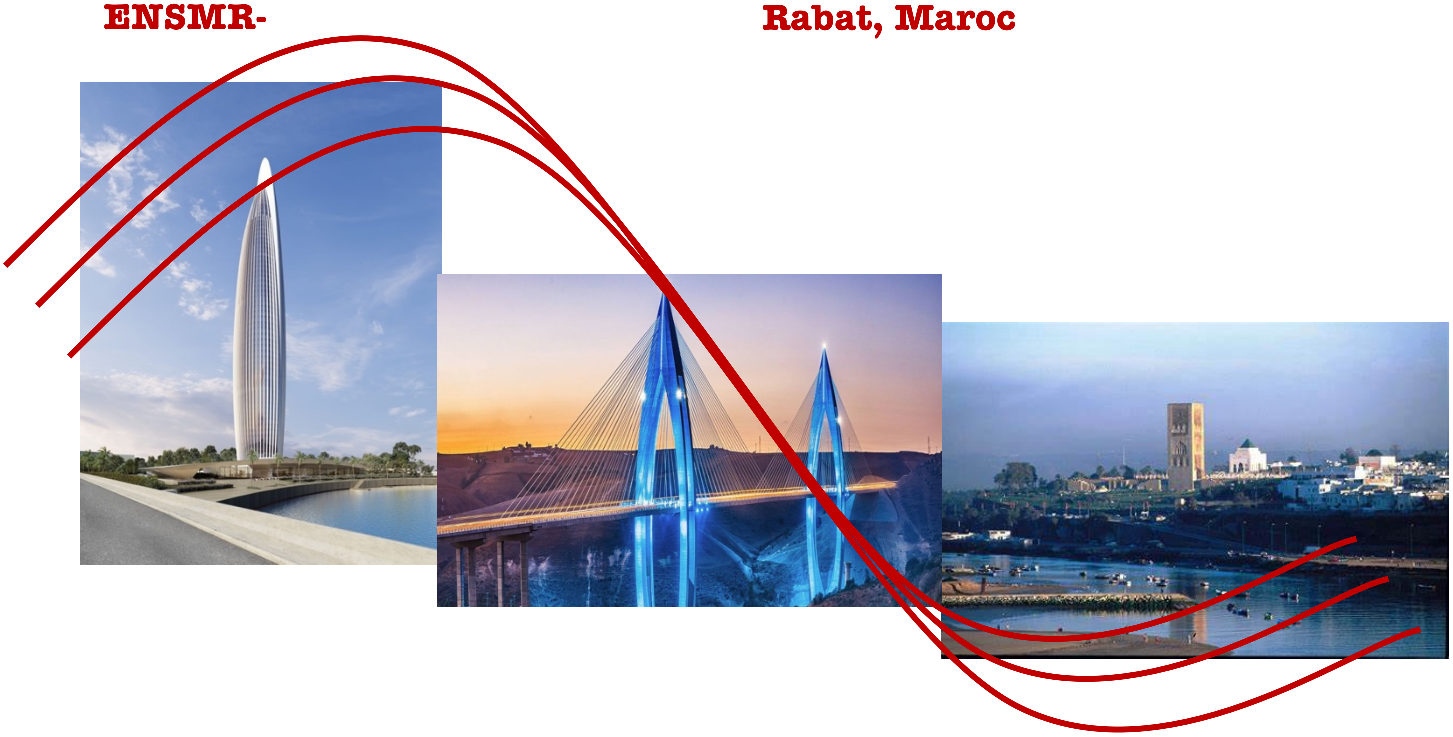
Jano'14	SM²A Société Marocaine de Mathématiques Appliquées	MINES-RABAT	LMAID Laboratoire de Mathématiques Appliquées et d'Informatique Décisionnelle

JANO'14 -Keynote Speakers

The 14th Edition of "Journées d'Analyse Numérique Optimisation"

20- 22 February, 2023

ENSMR- Rabat, Maroc



SCOOP

The main goal of this scientific meeting is to bring together researchers from different fields of Applied Mathematics, and more particularly researchers working in the field of numerical analysis, optimization, scientific computation, and the growing research domains of Data Science and Artificial Intelligence. The conference offers the possibility to develop new ideas and collaborations and to be aware of the latest search trends in numerical and optimization techniques and their applications in various fields. Participants will present and discuss their latest results in these areas. Thus, the 14th edition of JANO is an opportunity to discuss a number of research topics on recent developments in Applied Mathematics. This edition of the meeting follows thirteen previous editions which took place in different Moroccan universities and will be distinguished by the organization of a half-day dedicated to pedagogical engineering.

As a tradition, the conference offers the participants a friendly environment suitable for establishing scientific collaborations and fruitful exchanges.

International Conference of Numerical Analysis and Optimization Days (JANO'14)

February 20-22, 2023, Mines School of Rabat, Morocco

Robust shape optimization

Prof. Marc Dambrine

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Abstract :

In this presentation, I will study a particular class of shape optimization problems under uncertainties on the input parameters. The example that motivates this study is the optimization of a structure subjected to random loading.

In a first step, we are interested in minimizing the expectation of a quadratic objective in a situation where the state function depends linearly on a random input parameter. This framework covers important objectives such as tracking functions for second order elliptic partial differential equations and compliance in linear elasticity. We will show that the robust objective and its gradient are completely and explicitly determined by the low order moments of the random input. We then derive a cheap deterministic algorithm to minimize this objective and present model cases in structural optimization.

In this second step, in order to deal with more application-oriented objectives, I will present the extension to the case of any polynomial objective. This covers the Von Mises criterion and constraints on the compliance variance.

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Kolmogorov operators on noncompact metric graphs

Prof. Abdelaziz Rhandi
University of Salerno, Italy.

Abstract :

In this talk we first prove the existence of a classical solution to a class of parabolic problems with unbounded coefficients on noncompact metric graphs subject to Kirchhoff-type conditions. The result is applied to the Ornstein-Uhlenbeck and the harmonic oscillator operators on metric star graphs. We give an explicit formula for the associated Ornstein-Uhlenbeck semigroup and give the unique associated invariant measure. We show that this semigroup inherits the regularity properties of the classical Ornstein-Uhlenbeck semigroup on $\mathbb{R}$ and compute its spectrum.

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Continua of solutions and multiplicity for elliptic boundary value problems

Prof. Jose Carmona Tapia
University of Almeria, Spain

Abstract :

We deal with some elliptic boundary value problems where a bifurcation result leads to multiplicity of solutions. We consider a bounded domain $\Omega \subset \mathbb{R}^N$ ($N \geqslant 3$) and different PDE in Ω involving the Laplacian operator, Fractional Laplacian operators, Kirchhoff operators confronted with nonlinear terms depending on a real parameter.
From this point of view, we analyze some of the results recently obtained in [1], [2], [3], [4], [5].

Références

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Generative CAD model sampling and Generative (additive manufacturing) print-path design

Prof. Erkan Gnpnar
Istanbul Technical University

Abstract:
Generative design helps designers or engineers to explore high-performing and innovative design alternatives that they may never think of. Given a shape, CAD model is obtained via sketches and parametrization. Important features of the model are chosen as design parameters. After setting lower and upper limits of these parameters, a design space can be formed. Effectively sampling designs in the design space is crucial in many applications. First, a shape sampling technique that can be useful in conceptual design will be introduced. Another sampling techique for a computational fluid dynamics application will then be described. Main objective in this application is to obtain a machine learning model that can be used to predict drag coefficient of car side silhouttes. Finally, a new class of lattice structure family (called G-Lattice) will be detailed, which is obtained via a generative design algoritm considering additive manufacturing and user-defined criteria.

Last part of the talk contains generative (additive manufacturing) print-path design. First a helical printing technique will be introduced, where different print-paths are obtained by changing helix parameters. A print-path generation method (inspired from fluid flow) from hexahedral meshes will then be explained. All these print-paths can be manufactured via multi-axis additive manufacturing.

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Learning and exploiting the shape of data : a brief introduction to Topological Data Analysis.

Prof. Frederic Chazal
Paris-Saclay University, France

Abstract :

Topological Data Analysis (TDA) is a recent and fast growing field whose aim is to analyze, understand and exploit the topological and geometric structure of data. With the emergence of the mathematical theory of persistent homology, computational topology and geometry have provided a set of new efficient and mathematically well-founded topological and geometric tools to achieve this goal. This talk is an introduction to a few fundamental approaches and methods, including persistent homology, to estimate relevant topological information about data and take advantage of it in further learning tasks.
We will illustrate the interest of topological approaches on a few examples coming from concrete applications.

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An Inversion Strategy for Fully Characterizing Acoustic Elastic Scatterers.

Prof. Rabia Djellouli
California State University Northridge, USA

Abstract :
Recovering the characteristics of an unknown object such as a body or an inhomogeneity in a material from measurements of waves of fields scattered by this object is fundamental for exploring objects that are not accessible to in situ measurements. This class of problems is notoriously very difficult to investigate from both mathematical and computational aspects. In spite of their difficulties, inverse scattering problems have and continue to receive a great deal of attention by mathematicians, scientists, and engineers, as attested by the prolificness of papers and conferences dedicated to this topic. This is due, in part, to their relevance to a wide range of important applications such as seismology, radar and sonar, optics, along with many other areas in science and medical imaging technology. We discuss during the presentation various challenges for solving this class of inverse problems and provide a brief overview on the progress and accomplishments made in this area. We focus on the case of an elasto-acoustic scattering problem, as a prototype model problem, and present a novel solution methodology for determining all elastic scatterer parameters including the shape, the material properties (Lamé coefficients and density), and its location from the knowledge of far-field pattern (FFP) measurements. The proposed computational strategy is a multi-stage approach in which a carefully designed regularized iterative method plays a central role. The adopted approach is critical for recognizing that the different nature and scales of the sought-after parameters as well as the frequency regime have different effects on the scattering observability. Illustrative numerical results for two-dimensional elastic configurations highlight the performance of the designed inversion procedure.

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Nonlocal problems with critical nonlinearities

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Abstract :

Fractional and nonlocal operators appear in concrete applications in many different fields. This is one of the reason why, recently, nonlocal fractional problems are widely studied in the literature.
Aim of this talk will be to discuss some existence and multiplicity results for critical nonlocal problems got via variational and topological methods.

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Spatiotemporal patterns in the Belousov-Zhabotinskii reaction systems with nonsingular kernel derivatives

Prof. Zakia Hammouch

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(joint work with Kolade Owolabi)

Abstract :

This talk concerns a robust numerical method based on the fractional Adams-Bashforth and the Fourier spectral methods to explore some spatiotemporal patterns in a range of Belousov-Zhabotinskii reaction systems. The standard integer-order time-derivative is replaced with the Atangana-Baleanu fractional order derivative in the sense of Caputo. Details of existence and stability of positive solution are given. Numerical experiments are carried out at some instances of fractional power to demonstrate the suitability of the methods, and to explore the dynamic richness in some chemical species when modelled with non-integer-order derivatives.

Keywords : Fourier spectral method ; Existence of solution ; Fractional reaction-diffusion ; Spatiotemporal oscillations ; Stability analysis.

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