

27/09
2024

CRANED #8

Colóquio Rio de Janeiro de Análise e Equações Diferenciais

PUC-Rio
Ed. Leme,
12º andar
Sala Decanato

13h00: Cafezinho

13h20: Julia Domingues Lemos (UFRJ)

Machine learning aided closures of turbulence models

Even though turbulent fluid motion has been the subject of decades of active research, it still lacks an analytic description. Practical applications often require some level of modelling of small scales of motion, which we approach here in the form of a closure problem for a turbulence model. We aim to build a theoretically solid closure for the Sabra model, based on a dynamical rescaling of velocity fluctuations with the aid of machine learning tools. The rescaling will provide us with universal statistics, while a suitable machine learning tool will allow us to learn such statistics from data. This approach allows us to reproduce statistics of the fully resolved model, while including crucial information such as spatial and time correlations. This work is joint with F. Santos.

14h00: Reinaldo Resende (Carnegie Mellon)

Regularity results for area minimizing currents

In this presentation, we'll explore exciting new results on the interior and boundary regularity of currents T solving the oriented Plateau's problem, with a special focus on higher codimensions. We will extend well-known estimates concerning the Hausdorff dimension of the interior singular set of T to a broader context, and also share results from an upcoming work that optimally resolves several long-standing open questions on boundary regularity. Additionally, we'll discuss recent advancements on the rectifiability of the singular set, and, if time allows, showcase examples that highlight the optimality of all these results.

14h40: Coffee break

15h00: Miguel Soto (UNICAMP)

On the controllability properties for a higher-order dispersive system

In this talk deals with the boundary controllability of a family of nonlinear Boussinesq systems introduced by J. L. Bona, M. Chen and J.-C. Saut to describe the two-way propagation of small amplitude gravity waves on the surface of water in a canal. By combining the classical duality approach and a careful spectral analysis of the operator associated with the state equations, we first obtain the exact controllability of the linearized system in suitable Hilbert spaces. Then, by means of a contraction mapping principle, we establish the local exact controllability for the original nonlinear system. This work is joint with Ademir Pazoto and Sorin Micu.

15h40: Americo Cunha (UERJ)

The cross-entropy method for optimization in computational science and engineering

The Cross-Entropy (CE) method, a robust stochastic optimization technique, has garnered attention for its efficacy in addressing complex optimization problems across various disciplines. Originating from the field of rare event simulation, the CE method has evolved into a versatile tool for combinatorial optimization, continuous optimization, and machine learning tasks. Its core strategy involves generating sample solutions and iteratively refining probability distributions to hone in on the optimal regions of the solution space. This seminar introduces the CE method and its practical implementation through the CEopt code, a MATLAB-based framework designed to simplify the application of CE techniques. The CEopt code encapsulates the method's adaptability and effectiveness, featuring support for both constrained and unconstrained optimization problems. Its modular architecture, equipped with input validation, adaptive sampling mechanisms, and dynamic parameter adjustment, enables users to tackle a wide array of optimization challenges without deep dives into algorithmic intricacies. Participants from machine learning and computational mechanics backgrounds will find particular interest in how the CEopt code can integrate into their workflows to optimize performance metrics and system designs. This seminar will cover the theoretical foundations, practical considerations, and potential applications of the CE method, demonstrating its utility with real-world examples and discussing future directions in optimization technology.

17h00: Confraternização: Tio Ruy

