BOOK OF ABSTRACTS

CALCULUS OF VARIATIONS AND FREE BOUNDARY PROBLEMS VIII

11-12 APRILE 2024 - UNIVERSITÀ DI PISA

Spectral properties of Aharonov-Bohm operators in planar domains

Laura Abatangelo - Politecnico di Milano

The Aharonov-Bohm effect is a physical phenomenon which is observable in the context of quantum mechanics. In spite of its physical reason, its mathematical setting is very interesting and the spectral properties of the associated differential operator are found to be very rich. In this talk I would like to show an overview on this topic, possibly glancing at the theme of spectral minimal partitions.

Classification of solutions for a Gross-Pitaevskii type system

Francesco Esposito - Università della Calabria

This talk will be focused on the study of a family of semilinear elliptic systems defined in $\mathbb{R}^n$, which is doubly critical since it involves Sobolev critical exponents and Hardy-type potentials. We aim to provide qualitative properties of positive solutions for these Gross-Pitaevskii type systems. In particular, we shall deduce that solutions are symmetric about the origin. In order to do it, we apply a suitable version of the moving planes technique for cooperative singular systems. Finally, we are able to provide a classification result for these kind of problems.

This is based on a joint work with Rafael López-Soriano (University of Granada, Spain) and Berardino Sciunzi (University of Calabria, Italy).

An overdetermined problem related to spectral methods in 2D linearised hydrostatics

Giovanni Franzina - CNR Roma

Two-dimensional viscous incompressible flows do not experience any vortex stretch, the vorticity is merely transported by the velocity field, and the boundary conditions on the latter dictate the appropriate conditions for the vorticity in accord with a rather simple relation. We discuss some consequences of this relation, that are relevant to a spectral problem of interest for fluids confined within rigid walls in the formal low Reynolds number limit. In particular, we discuss the rigidity of homogeneous Neumann boundary conditions when solving for the

pressure, and we deduce that the only possible minimiser of the first eigenvalue of the Stokes operator under area constraint in the class of smooth and simply connected planar open sets is the disc.

Energy Optimization and Overdetermined Problems in Cones and Cylinders

Alessandro Iacopetti - Università degli studi di Torino

In this talk, we present some recent results concerning partially overdetermined problems relative to an unbounded region. Specifically, we focus on the cases of cones and cylinders and investigate the stability/instability of certain classes of solutions, which are naturally connected to the geometry of the container. Additionally, we discuss the existence of minimizers of the torsional energy under a volume constraint.

These results are part of a series of joint works with Prof. F. Pacella (Univ. of Rome "La Sapienza"), Prof. T. Weth (Univ. of Frankfurt), Dott. D. Gregorin (Univ. of Urbino), and Prof. P. Caldiroli (Univ. of Turin).

Constructions for a C^1 function with prescribed gradient on a Cantor-type set

Annalisa Massaccesi - Università degli studi di Padova

In this talk I will outline the iterative construction of a C^1 function u, with $\|u\|_\infty \leq \eta$ and $Du(x) = F(x, u(x))$ on a Cantor-type set C. It is transparent from the construction the presence of a trade off between the size of C and the Hölder regularity of Du. This type of construction is the building block for counterexamples to Frobenius theorem when the tangency set is not regular enough.

Shape optimization for Hartree energies

Berardo Ruffini - Università di Bologna

In the talk I will introduce variational models where a aggregating terms compete with repulsive ones. Examples of such models arise naturally in different physical fields. It is the case of the Gamow [liquid drop] model and the Hartree energies in quantum mechanics, or the Rayleigh liquid charged drop model in electrowetting theories.
I will give an overview of the recent strategies to get well-or-ill posedness of these energies. Then I will focus on a particular case -the reduced Hartree energy of the atom of Helium in a confined potential field- and show a strategy in order to characterize minimizers for such an energy. I will eventually show how in certain regimes no minimizers occur.

The talk is based on an ongoing project with Dario Mazzoleni (Pavia) and Cyrill B. Muratov (Pisa).