



Tuesday the 04 December 2018 at 10:00
Politecnico di Torino, DISMA, Aula Buzano (third floor)

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Positive solutions to indefinite problems: a topological approach

Prof. Maria Vallarino introduces the seminar

Abstract

Starting from the Eighties, a great deal of attention has been devoted to the investigation of nonlinear boundary value problems (BVPs) with a sign-indefinite weight, especially in connection to partial differential equations of the form $-\Delta u = a(x)g(u)$. This kind of differential problems arises in many models concerning mathematical ecology, differential geometry and mathematical physics.

In this seminar, Dr Guglielmo Feltrin will present some recent existence and multiplicity results for positive solutions of BVPs associated with second-order nonlinear indefinite differential equations. More precisely, he will deal with the ordinary differential equation $u'' + a(t)g(u) = 0$, where $a: [0, T] \rightarrow \mathbb{R}$ is a Lebesgue integrable sign-changing weight and $g: [0, +\infty[\rightarrow [0, +\infty[$ is a continuous nonlinearity. He will focus on the periodic BVP and on functions $g(u)$ with superlinear growth at zero and at infinity (including the classical superlinear case $g(u) = u^p$, with $p > 1$). Exploiting a new approach based on topological degree theory, he will show that there exist $2^m - 1$ positive solutions when $a(t)$ has m positive humps separated by negative ones, and the negative part of $a(t)$ is sufficiently large. In this manner, Dr Feltrin will give a complete answer to a question raised by Butler (JDE, 1976) and he will solve a conjecture by Gómez-Reñasco and López-Gómez (JDE, 2000). The method also applies to Neumann and Dirichlet boundary conditions and, furthermore, provides a topological approach for detecting infinitely many subharmonic solutions and globally defined positive solutions with chaotic behaviour.

After that, Dr Feltrin will illustrate other directions for the research on indefinite problems: super-sublinear problems, models in population genetics, and also problems involving more general differential operators, as the Minkowski-curvature one or the one-dimensional p -Laplacian. Exact multiplicity results and indefinite problems in the PDE setting will be also discussed.

The talk is based on joint works with Alberto Boscaggin (University of Torino), Elisa Sovrano (University of Porto), Fabio Zanolin (University of Udine), and his book "Positive Solutions to Indefinite Problems. A Topological Approach" (Frontiers in Mathematics, Birkhäuser/Springer, 2018).

Biography

Guglielmo Feltrin is an Assistant Professor at the Department of Mathematical Sciences of Politecnico di Torino. After his higher education at the University of Udine, he obtained his PhD in Mathematical Analysis in 2016 from SISSA, Trieste, under the supervision of Prof. Fabio Zanolin. He worked as a Post-doc and FNRS Chargé de Recherches at the University of Mons (Belgium) and as a Post-doc at the University of Torino. His research interests include Nonlinear Analysis, Ordinary Differential Equations, Dynamical Systems, and Celestial Mechanics.

Save the date for the next event: **December 11, 2018**

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