Lifespan estimates for solutions of p-Kirchhoff systems.

Giuseppina Autuori
Polytechnical University of Marche, Italy
giuseppina.autuori@unipg.it

In this talk we shall present some perturbed evolution systems governed by the p-Kirchhoff operator in bounded domains. These models are characterized by time dependent nonlinear driving forces and dynamic boundary conditions. The question of non-continuation of maximal solutions will be discussed and some a priori estimates for the lifespan of solutions will be given.

Existence and multiplicity of solutions for second order periodic systems with a nonsmooth potential

Giuseppina Barletta
University of Reggio Calabria, Italy
giuseppina.barletta@unirc.it

We present some existence and multiplicity results for the following second order periodic system with a nonsmooth potential

\[
\begin{align*}
-\phi_p(u') - A(t)u &\in \partial j(t,x(t)) \quad \text{a.e. on } T = [0,b], \\
x(0) &= x(b), \quad x'(0) = x'(b).
\end{align*}
\]

Here \( A : T \to R^{N×N} \) is a continuous map and for every \( t \in T \), \( A(t) \) is a symmetric \( N \times N \)-matrix. Also \( j : T \times R^N \to R \) is a measurable function, which is locally Lipschitz and in general nonsmooth in the \( x \in R^N \) variable. We provide different sets of verifiable hypotheses on \( j(t,x) \) ensuring the existence of at least one or two nontrivial solutions of the problem above. In particular, in an existence theorem the Euler functional is coercive and bounded below, in others it is unbounded and in still others it is bounded below but not coercive. Furthermore, in some cases, the analytical framework incorporates strongly resonant periodic systems.

A local minimum theorem and applications

Gabriele Bonanno
Messina University, Italy
bonanno@unime.it

A local minimum theorem is presented and applications to nonlinear problems, as elliptic Dirichlet problems with critical growth, are given. Relations between the mountain pass theorem and local minima are pointed out. As a consequence, multiple critical points theorems, as a theorem of two nonzero critical points, are obtained. Finally, multiplicity results for wide classes of nonlinear problems are established.

Periodic solutions of second order ODEs: a symplectic approach

Alberto Boscaggin
University of Milano-Bicocca, Italy
alberto.boscaggin@unimib.it

Rafael Ortega, Fabio Zanolin

We present some recent applications of the Poincaré-Birkhoff fixed point theorem to the search of periodic (harmonic and subharmonic) solutions of second order ordinary differential equations. Joint works with Rafael Ortega (University of Granada) and Fabio Zanolin (University of Udine).

Optimization of the principal eigenvalue under mixed boundary conditions

Lucio Cadeddu
Dept. of Mathematics and Computer Science, Italy
lucio.cadeddu@unica.it

G. Porru, M.A. Parina

We investigate minimization and maximization of the principal eigenvalue of the Laplacian under mixed boundary conditions in case the weight has indefinite sign and varies in a class of rearrangements. In special cases, we prove results of symmetry and results of symmetry breaking for the optimizers (minimizers).

Some multiplicity results for p-Laplacian type problems with an asymptotically p-linear term

Anna Maria Candela
University of Bari, Italy
annamaria.candela@uniba.it

Let us consider the p-Laplacian type equation

\[
\begin{align*}
-\operatorname{div}(A(x,u)|\nabla u|^{p-2} \nabla u) &+ \frac{1}{p} A_p(x,u)|\nabla u|^p = f(x,u) \quad \text{in } \Omega, \\
u &= 0 \quad \text{on } \partial \Omega,
\end{align*}
\]

where \( \Omega \subset R^N \) is a bounded domain, \( N \geq 2, p > 1 \), \( A : \Omega \times R \rightarrow R \) is a given function which admits the partial derivative \( A_p(x,u) = \frac{dA}{du}(x,u) \) and \( f : \Omega \times R \rightarrow R \) is asymptotically p-linear at infinity. Under suitable hypotheses both at the origin and at infinity and by using variational tools and index theories we prove some multiplicity results in the non-resonant case when \( A(x,\cdot) \) is even and \( f(x,\cdot) \)
is odd. Joint works with Giuliana Palmieri and Kanishka Perera.

Constant-sign solutions for nonlinear discrete problems
Pasquale Candito
University of Reggio Calabria, Italy
pasquale.candito@unirc.it

The talk makes the point on some recent existence and multiplicity results for difference equations obtained by requiring nonstandard conditions on the nonlinearities. The approach adopted is based on variational methods on finite dimensional Banach spaces, truncations techniques and the discrete maximum principle. In particular, it points out that, in some cases, such results are not the analogous of those achieved by using the same tools for the corresponding differential equations.

Linear and nonlinear eigenvalue problems for Dirac systems in unbounded domains
Anna Capietto
University of Torino, Italy
anna.capietto@unito.it

Walter Dambrosio, Duccio Papini

It is proved the existence of a continuum of solutions of a special form to a nonlinear partial differential equation of Dirac type. To this end, we use the notions of “partial wave subspace”, in connection with the well-known concept of rotation number.

Multi-valued variational inequalities versus variational-hemivariational inequalities
Siegfried Carl
University Halle, Germany
siegfried.carl@mathematik.uni-halle.de

We present recent existence and enclosure results for multi-valued variational inequalities and related variational-hemivariational inequalities.

Existence and multiplicity results for elliptic problems with variable exponent
Antonia Chinni
DICIEAMA, University of Messina, Italy
achinni@unime.it

We present a collection of results on the existence and multiplicity of weak solutions for some elliptic problems involving the \( p(\cdot) \)-Laplace operator where \( p \in C(\Omega) \) and \( \Omega \subset \mathbb{R}^N \) is an open bounded domain with smooth boundary. In particular, under an appropriate oscillating behaviour of the nonlinearity \( f \), the Neumann and Dirichlet problems will be studied in the case \( 1 < p^- \leq p(x) \leq p^+ < +\infty \). The results are based on variational methods.

Some existence results for a semilinear elliptic problem with a singular term
Francesca Faraci
Catania University, Italy
ffaraci@dm.unict.it

G. Anello, Cs. Farkas

We discuss some existence results for a semilinear elliptic equation involving a singular term of the type \(-\Delta u = f(u) + u^{q-1}\), coupled with Dirichlet boundary conditions. We assume that \( q \in [0,1] \) and \( f \) is a continuous function. Under different assumptions on \( f \) we will prove the existence of a positive solution for our problem. Our approach is variational and combines methods from classical critical point theory.

Comparison and positive solutions for a class of dirichlet problem involving the \((p,q)\)-laplacian
Luiz Fernando Farina
Universidade Federal de Juiz de Fora, Brazil
luiz.faria@ufjf.edu.br

Olimpio Hiroshi Miyagaki, Dumitru Motreanu

The aim of this paper is to prove the existence of a positive solution for a quasi-linear elliptic problem involving the \((p,q)\)-Laplacian and a convection term, which means an expression which is not in the principal part and depends on the solution and its gradient. The solution is constructed through an approximating process based on gradient bounds and regularity up to the boundary. The positivity of the solution is shown by applying a new comparison principle which is established here.

Optimization of the principal eigenvalue under mixed boundary conditions
Maria Antonietta Farina
University of Cagliari, Italy
mfarina@unica.it

G. Porru, L. Cadeddu

We investigate biologically-oriented problems, motivated by the question of determining the most convenient spatial arrangement of favorable and unfavorable resources for a species to survive or to decline. We prove existence and uniqueness results, and present some features of optimizers.

A quasilinear elliptic equations involving critical Sobolev exponents
Csaba Farkas
Babes Bolyai University, Cluj Napoca, Romania
farkas.csaba2008@gmail.com

Francesca Faraci

In the present talk we consider the following quasilinear elliptic equation \(-\Delta_p u = |u|^{p^-2}u + g(u)\), in \( \Omega \) coupled with Dirichlet boundary condition, where \( \Omega \) is a bounded domain of \( \mathbb{R}^N \) with smooth boundary \( \partial \Omega \). \( g \) is a continuous function with suitable growth condition. We will prove the existence of a weak solution for problem by
combining semicontinuity argument with direct methods of calculus of variations. The existence of a local minimum for the energy functional is ensured provided a suitable algebraic inequality is fulfilled.

**Multiple positive solutions for a superlinear problem: a topological approach**

Guglielmo Feltrin
SISSA, Italy
gfeltrin@sissa.it

Fabio Zanolin

We study the multiplicity of positive solutions for a two-point boundary value problem associated to the nonlinear second order equation $u'' + f(x, u) = 0$. We allow $x \mapsto f(x, s)$ to change its sign in order to cover the case of scalar equations with indefinite weight. Roughly speaking, our main assumptions require that $f(x, s)/s$ is below $\lambda_1$ as $s \to 0^+$ and above $\lambda_1$ as $s \to +\infty$. In particular, we can deal with the situation in which $f(x, s)$ has a superlinear growth at zero and at infinity. We propose a new approach based on topological degree which provides the multiplicity of solutions. Applications are given for $u'' + a(x)g(u) = 0$, where we prove the existence of $2^n - 1$ positive solutions when $a(x)$ has $n$ positive humps and $a^{-1}(x)$ is sufficiently large.

**Nodal solutions for Neumann problems with a nonhomogeneous differential operator**

Michael Filippakis
University of Piraeus, Dept. of Digital Systems, Greece
mfilip@unipi.gr

Nikolaos S. Papageorgiou

In this paper, we consider a nonlinear elliptic equation driven by the $p$-Laplace and with a parameter $\lambda > 0$. Using a combination of variational and degree theoretic methods, we prove that there exists $\lambda^* > 0$ such that if $\lambda > \lambda^*$, then the problem has two positive smooth solutions. Our result extends earlier ones by Rabinowitz (semilinear equations) and Guo (nonlinear equations) of variational eigenvalues of a differential operator. First proved by Weyl (1912) for the Laplacian, it was extended by Garcia Azorero-Peral Alonso (1988) and Friedlander (1989) to the p-Laplacian. We define a sequence of variational min-max eigenvalues for the fractional p-Laplacian and prove a two-side asymptotic estimate for it. The method relies on the cohomological index and Krasnosel’skii genus.

**An abstract existence result for solitons and applications**

Donato Fortunato
University of Bari Italy, Italy
donato.fortunato@uniba.it

Vieri Benci

We state an abstract existence theorem for solitons and we apply this theorem to some field equations.

**A recent result about existence of periodic solutions to the Brillouin equation**

Maurizio Garrione
Università di Milano-Bicocca, Italy
maurizio85.g@gmail.com

Manuel Zamora

We will deal with the scalar second order equation (known as Brillouin electron beam focusing equation)

$$x'' + b(1 + \cos t)x = \frac{1}{x},$$

where $b$ is a positive constant. A classical problem related to this equation is to determine the values of $b$ for which there exists a $2\pi$-periodic positive solution. This gave rise to an unproven conjecture, motivated by some numerical experiments, saying that this always happens if $b \in (0, 1/4)$. In this talk, we present a new range of values of $b$ for which the Brillouin equation has a $2\pi$-periodic solution, disjoint from the conjectured one $(0, 1/4)$. Precisely, we will prove $2\pi$-periodic solvability for $b \in [0.4705, 0.59165]$. The technique of proof relies on careful estimates of the rotation numbers of the solutions in the phase-plane, under suitable nonresonance assumptions which will be briefly commented.

**Periodic solutions for a class of second-order differential systems with impulses**

Shapour Heidarkhani
Razi University, Iran
sh.heidarkhani@yahoo.com

Based on variational methods and critical point theory, under suitable assumptions on the nonlinear terms, we establish the existence of multiple periodic solutions for a class of perturbed second-order differential systems with impulses. We illustrate the results by giving convenient examples.

**Weyl-type laws for fractional $p$-eigenvalues**

Antonio Iannizzotto
University of Verona, Italy
antonio.iannizzotto@univr.it

Marco Squassina

Weyl’s law yields an estimate of the asymptotic behavior of variational eigenvalues of a differential operator. First proved by Weyl (1912) for the Laplacian, it was extended by Garcia Azorero-Peral Alonso (1988) and Friedlander (1989) to the p-Laplacian. We define a sequence of variational min-max eigenvalues for the fractional p-Laplacian and prove a two-side asymptotic estimate for it. The method relies on the cohomological index and Krasnosel’skii genus.

**On some boundary value problems with singular Laplacians**

Petru Jebelean
West University of Timisoara, Romania
jebelean@math.utv.ro

We survey recent results on multiplicity of periodic solutions for some $N$-dimensional relativistic equations. Also, we present existence and multiplicity results for Dirichlet problems involving the mean extrinsic curvature operator in Minkowski space. The talk is based on joint work with
Existence Results and Inverse Problems for Evolutionary Quasi Variational Inequalities

Akhtar Khan
Rochester Institute of Technology, USA
aaksma@rit.edu

D. Motreanu

This paper gives new existence results for parabolic and elliptic quasi variational inequalities. We will also study an inverse problem for quasi variational inequalities.

Topological invariants of almost Hamiltonian systems with singularities of symplectic structure

Mikhail Kharrlamov
Presidential Academy NEPA, Russia
mikeh@inbox.ru

In a non-reducible integrable Hamiltonian system with three degrees of freedom, we can present the set of the critical points of the momentum mapping as a union of the phase spaces of Hamiltonian systems with less number of degrees of freedom. In such critical subsystems, manifolds of co-dimension 1 can exist, on which the induced symplectic structure degenerates. Sometimes the topology of a critical subsystem does not notice such degeneration. In this case the theory of the Fomenko-Zieschang topological invariants can be applied. The corresponding example is the integrable system with two degrees of freedom found by O.I.Bogoyavlensky in the dynamics of a heavy magnet. In other problems we come across bifurcations which are impossible in the systems without singularities of the symplectic form. Moreover, we present an example of a critical subsystem with two degrees of freedom having non-orientable phase space. In this system, new types of loop molecules, non-orientable 3-atoms and bifurcations arise. We classify 3-dimensional isoenergetic manifolds which are S1-bundles over orientable or non-orientable 2-dimensional surfaces. The investigation is carried out with the help of algebraic separation of variables found for this system. Such separating gives rise to a universal algorithm of calculating exact topological invariants of the system in the form of gluing matrices.

A variational approach to Nash equilibria on Riemannian manifolds

Alexandru Kristaly
Babes-Bolyai University, Romania
alexandru.kristaly@yahoo.com

The concept of Nash-Stampacchia equilibrium points is introduced via variational inequalities on Riemannian manifolds. Characterizations, existence, and stability of Nash-Stampacchia equilibria are studied when the strategy sets are compact/noncompact geodesic convex subsets of Hadamard manifolds, exploiting two well-known geometrical features of these spaces both involving the metric projection map. Our analytical approach exploits various elements from set-valued and variational analysis, dynamical systems, and non-smooth calculus on Riemannian manifolds. The talk is based on the paper: A. Kristaly, Nash-type equilibria on Riemannian manifolds: a variational approach, J. Math. Pures Appl., in press.

Infinitely many solutions for a nonlinear Klein-Gordon-Maxwell System

Lin Li
Southwest University, China, Peoples Rep of China
liilin429@gmail.com

Chun-Lei Tang

In this paper, a nonlinear Klein-Gordon-Maxwell System with solitary waves solution is considered. Using critical point theory, we establish sufficient conditions for the existence of infinitely many solitary waves solutions. Results obtained improve and unify the existing ones for the Klein-Gordon-Maxwell System with non-constant potential even for the Schrödinger-Poisson System with non-constant potential.

Nodal and multiple solutions for a Dirichlet problem involving the p-Laplacian

Roberto Livrea
Reggio Calabria University, Italy
roberto.livrea@unirc.it

P. Candito and S. Carl

The talk deals with some recent multiplicity results, jointly obtained with P. Candito and S. Carl, for a parametric Dirichlet quasilinear problem. In particular, it will be shown how the combined use of variational methods and the sub-supersolution techniques assured the existence of explicit intervals of parameters for which the problem under examination admits multiple solutions satisfying some sign conditions, as well as a priori estimate. An alternative approach based on the pseudomonotone operator theory will be also outlined.

An approximation solvability method for nonlocal differential problems in Hilbert spaces

Luisa Malaguti
University of Modena and Reggio Emilia, Italy
luisa.malaguti@unimore.it

I. Benedetti, N.V. Loi and V. Obukhovskii

A new approach is developed for the solvability of nonlocal problems in Hilbert spaces associated to nonlinear differential equations. Periodic, anti-periodic, mean value and multipoint conditions are included in this study. The investigation is based on a joint combination of the degree theory with the approximation solvability method, Hartman-type inequalities are involved. No compactness or condensivity conditions on the nonlinearities are assumed. Applications to the study of integro-differential equations and systems of integrodifferential equations are showed. The method is then extended to a multivalued setting and a feedback control problem is discussed.
Non-smooth critical point theory on closed convex sets and applications
Salvatore Marano
University of Catania, Italy
marano@dmi.unict.it
Sunra J.N. Mosconi
The existence of critical points for a locally Lipschitz continuous functional $F$ on a closed convex set $C$ of a Banach space $X$ is investigated. The problem of finding extra conditions under which critical points for $F$ on $C$ turn out to be critical on $X$ is also addressed. Some applications concerning elliptic variational-hemivariational inequalities are then worked out.

Bounds for blow-up time in nonlinear parabolic problems under various boundary conditions
Monica Marras
University of Cagliari, Italy
mmarras@unicas.it
Stella Vernier-Piro
The question of blow-up of solutions to nonlinear parabolic equations and systems has received considerable attention in the recent literature. In practical situations one would like to know among other things whether the solution blows up and, if so, at which time blow-up occurs. When the solution does blow up at some finite time $T$, this time can seldom be determined explicitly, so much effort has been devoted to the calculation of estimates for $T$. Most of the methods used until recently have yielded only estimates from above for $T$, so that in particular problems in which blow-up has to be avoided, they are of little value. We are mainly interested in estimates from below. In particular, we investigate the question of blow-up for nonnegative classical solutions of some nonlinear parabolic problems defined in bounded domains. Under conditions on data and geometry of the spatial domain, explicit estimates from below for the blow-up time are derived.

On a class of the nonhomogeneous eigenvalue problems and applications
Olimpio Miyagaki
UFJF-Universidade Federal de Juiz de Fora, Brazil
ohmiyagaki@gmail.com
J.M. Do O, S. Moreira Neto
in this work we establish the existence of standing wave solutions for quasilinear Schrödinger equations involving subcritical growth at resonance. By using a change of variables, the quasilinear equation is reduced to semilinear one, which associated functional is well defined in the usual Sobolev space. The “first” eigenvalue type of a nonhomogeneous operator was studied. Using this fact and a variant of the monotone operator theorem, we show that the problem at resonance has at least one nontrivial solution.

Nonlinear elliptic problem driven by a nonhomogeneous operator
Dumitru Motreanu
University of Perpignan, France
motreanu@univ-perp.fr
The obtained results ensure existence of multiple solutions, under Dirichlet and Neumann boundary conditions, for nonlinear elliptic equations whose differential part is expressed through a nonhomogeneous operator. The presence of the non-homogeneity raises serious difficulties, especially related to the eigenvalue problems. Through our approach, information regarding the sign of solutions is available.

A quasilinear singular elliptic system with superhomogeneous condition
Abdelkrim Moussaoui
A. Mira Bejaia University, Algeria
remdz@yahoo.fr
Claudianor O. Alves
In the present contribution we establish the existence of at least two distinct (positive) smooth solutions of a singular quasilinear system of elliptic equations with superhomogeneous condition. The proof of existence of the first solution is based on the sub-supersolution methods for systems of quasilinear equations combined with perturbation arguments involving singular terms. The structure of the singular terms in the system is essentially used to construct the sub-supersolution. The second solution is obtained via topological degree argument combined with a priori bounds of solutions.

A multiplicity result for the scalar field equation
Kanishka Perera
Florida Institute of Technology, USA
kperera@fit.edu
We prove the existence of $N-1$ distinct pairs of nontrivial solutions of the scalar field equation in $\mathbb{R}^N$ under a slow decay condition on the potential near infinity, without any symmetry assumptions. Our result gives more solutions than the existing results in the literature when $N \geq 6$. When the ground state is the only positive solution, we also obtain the stronger result that at least $N-1$ of the first $N$ minimax levels are critical, i.e., we locate our solutions on particular energy levels with variational characterizations. Finally we prove a symmetry breaking result when the potential is radial. To overcome the difficulties arising from the lack of compactness we use the concentration compactness principle of Lions, expressed as a suitable profile decomposition for critical sequences.

Existence of entire solutions for a class of variable exponent elliptic equations
Patrizia Pucci
Università di Perugia, Italy
patrizia.pucci@unipg.it
Qihu Zhang

The talk deals with the existence of entire solutions of a quasilinear equation in $\mathbb{R}^N$, which involves a general variable exponent elliptic operator $A$ of the $p(x)$-Laplacian type in divergence form and two main nonlinearities of growth $q = q(x)$ and $r = r(x)$, involving two coefficients. The results we present extend the previous work in several directions. We first weaken the condition $\max(2,p)< q < \min\{r,p\}$ to the simpler request that $1 << q << r$. We also ask milder assumptions on the coefficients of the nonlinearities, as well as a very weak ellipticity condition on $A$. The results we present are new even in the case of constant exponents and even in the semilinear case $p \equiv 2$.

Bifurcations of First Integrals in the Goryachev case

Pavel Ryabov
Financial University, Russia
orelryabov@mail.ru

The Chaplygin case (1903) of the problem of rigid body motion in fluid was generalized by D.N.Goryachev (1916) to the problem with the potential that has a singularity in the equatorial plane of the inertia ellipsoid. In this talk we represent the results on the phase topology of particular case of D.N.Goryachev integrability. To study the phase topology for the Goryachev case, we use the explicit real separation of variables. This fact helped us to obtain the explicit form of the Abel-Jacobi equations with the sixth power polynomial under the radical and the algebraic expression of all phase variables in terms of real separated variables. The analytic formulas obtained allow us to study phase topology, in particular, bifurcations of Liouville tori. The investigation is carried out with the help of the method of Boolean functions developed by M.P.Kharlamov for algebraically separable systems. We found the bifurcation diagram of the moment map by M.P.Kharlamov for algebraically separable systems. The proofs are mainly based on variational methods, Ekeland principle, Mountain pass lemma and Fountain theorem. We investigate the relationship between the growth rates of principal part, convex and concave part which can not be appeared in p-Laplacian problems.

Numerical extremal solutions for a mixed problem with singular $\phi$-Laplacian

Calin Serban
West University of Timisoara, Romania
cserban2005@yahoo.com

We are concerned with extremal solutions for the mixed boundary value problem

$$-(\phi(u'))' = r^{N-1}g(r,u), \quad u(0) = 0 = u(R),$$

where $g : [0,R] \times \mathbb{R} \to \mathbb{R}$ is a continuous function and $\phi : [0,\infty) \to \mathbb{R}$ is an increasing homeomorphism with $\phi(0) = 0$. We prove the existence of minimal and maximal solutions in presence of well-ordered lower and upper solutions and we develop a numerical algorithm for theirs approximation. The talk is based on joint work with Petru Jebelean and Constantin Popa.

Some distinct phenomena in $p(x)$-Laplacian problems

Inbo Sim
University of Ulsan, Korea
ilosim@ulsan.ac.kr

Ky Ho
University of Ulsan, Korea

In this talk, we show the existence results of nontrivial nonnegative solutions for degenerate $p(x)$-Laplacian problems with weighted convex and concave terms which have a parameter. The proofs are mainly based on variational methods, Ekeland principle, Mountain pass lemma and Fountain theorem. We investigate the relationship between the growth rates of principal part, convex and concave part which can not be appeared in p-Laplacian problems.

Positive solutions for nonlinear elliptic equations with a singular term

George Smyrlis
National Technical University of Athens, Greece
gsmyrlis@math.ntua.gr

Nikolaos S. Papageorgiou

In this contribution we study nonlinear elliptic problems with a singular term of the form

$$-\text{div}(a(Du(z))) = \beta(z)u(z)^{-\gamma} + f(z,u(z)), \quad \text{for almost all } z \in \Omega,$$

$$u |_{\partial \Omega} = 0, \quad \gamma \in (0,1),$$

where $\Omega \subseteq \mathbb{R}^N$ ($N \geq 1$) is a bounded domain with a $C^2$-boundary $\partial \Omega$, $a : \mathbb{R}^N \to \mathbb{R}^N$ is strictly monotone with certain regularity properties and $\beta \in C(\Omega) \cap L^\infty(\Omega)^+ \setminus \{0\}$. Moreover, $f \in C(\Omega \times \mathbb{R})$ being either superlinear near $+\infty$ (without satisfying the Ambrosetti-Rabinowitz condition) or sublinear near $+\infty$. We prove three multiplicity theorems producing at least two smooth positive solutions for problems of the above form. In the first one, the leading differential operator is not in general homogeneous and the result is obtained for “small” $||b||_{\infty}$.

The other two results concern problems driven by the $p$-Laplacian differential operator. In these cases, no restrictions are imposed on $||b||_{\infty}$. Our approach is variational.
employing suitable truncation and comparison techniques.

A logarithmic Schrödinger equation with periodic potential

Andrzej Szulkin
Department of Mathematics, Stockholm University, Sweden
andrzejs@math.su.se

Marco Squassina

We consider the logarithmic Schrödinger equation

\[-\Delta u + V(x)u = Q(x)u \log u^2, \quad u \in H^1(\mathbb{R}^N),\]

where \(V, Q\) are periodic in \(x_1, \ldots, x_N\). \(Q > 0\) and \(V + Q > 0\). We show that this equation has infinitely many geometrically distinct solutions and that one of these solutions is positive. The main difficulty here is that the functional associated with this problem is lower semicontinuous and takes the value \(+\infty\) for some \(u \in H^1(\mathbb{R}^N)\).

Generalized eigenvalue problems for \((p,q)\)-Laplacian with indefinite weight

Mieko Tanaka
Tokyo University of Science, Japan
tanaka@ma.kagu.tus.ac.jp

In this talk, I will talk existence and non-existence results on a positive solution for quasilinear elliptic equations of the form \(-\Delta u - \mu \Delta_s u = \lambda m(x)|u|^{r-2}u\) in \(\Omega\).

Positive solutions for a system of nonlinear integral boundary value problems

Rodica Luca Tudorache
Technical University of Iasi, Romania
rilucatudor@yahoo.com

Johnny Henderson

We investigate a system of nonlinear second-order ordinary differential equations with two eigenvalues, subject to integral boundary conditions. Under some assumptions on the eigenvalues and nonlinearities, we prove the existence and nonexistence of positive solutions. In a special case, we also study the multiplicity of positive solutions by applying the fixed point index theory.

Sharp pointwise estimates from above and from below for solutions to a class of singular parabolic problems

Stella Vernier-Piro
University of Cagliari, Italy, Italy
svernier@unica.it

Vincenzo Vespri, Francesco Ragnedda

This is a joint research with Vincenzo Vespri and Francesco Ragnedda. We deal with the Cauchy problem associated to a class of quasilinear singular parabolic equations with \(L^\infty\) coefficients, which prototypes are the \(p\)-Laplacian and the Porous medium equation (in the supercritical range).

Estimates for the \(p\)-Laplacian and Porous medium equations (both for the slow diffusion and fast diffusion case) have been considered by several authors. To prove estimates for more general operators, we are forced to use a completely different and more sophisticated approach, based on DiBenedetto’s techniques, recent Harnack inequalities and De Giorgi estimates. Sharp pointwise estimates from above and from below for the fundamental solutions are derived, assuming as initial data the Dirac mass. Our results can be extended to general nonnegative \(L^1\) initial data.

Blowing up and global solutions of a nonlinear parabolic problem

Giuseppe Viglialoro
University of Cagliari, Italy, Italy
giuseppe.viglialoro@unica.it

M. Marras, S. Piro-Vernier

This session deals with the blowing up and global solutions of a nonlinear and weakly coupled parabolic system, containing gradient terms, under Dirichlet boundary conditions. The blow-up phenomena of its positive solutions are analyzed and, in particular, an analytical estimate of the lower bound of the blow-up time is obtained. Moreover, we propose a resolution algorithm capable to solve the original problem. The numerical examples both confirm the theoretical result and allow to observe other interesting phenomena connected to the behavior of the solutions, as for instance their global existence.

Resonant \((p,2)\)-equations with concave terms

Patrick Winkert
Technische Universitaet Berlin, Germany
winkert@math.tu-berlin.de

Nikolaos S. Papageorgiou

We consider a nonlinear, nonhomogeneous parametric elliptic Dirichlet equation driven by the sum of a \(p\)-Laplacian and a Laplacian (so-called \((p,2)\)-equation) and with a nonlinearity involving a concave term which enters with a negative sign. By applying variational methods along with truncation and comparison techniques as well as Morse theory, we show that the problem under consideration has at least five nontrivial solutions (four of them have constant sign) for all sufficiently small values of the parameter.

A fixed point theorem on topological cylinders, with applications

Fabio Zanolin
University of Udine, Italy
fabio.zanolin@uniud.it

We present a fixed point theorem for completely continuous operators in Banach spaces, which makes use of a “stretching along the paths” property and we also show some applications to existence and multiplicity of solutions for nonlinear equations in different situations (both in the case of finite and infinite dimensional spaces). The main abstract results are based on joint work with Duccio Papini (University of Siena) and recent developments by
Guglielmo Feltrin (SISSA, Trieste). Some applications to periodic boundary value problems are proposed.