Abbas Barhi

Periodic Orbits of Contact Vector-Fields in dimension 3.

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We establish the existence of a homology for the periodic orbits of a contact vector-field, in dimension 3, that is invariant by deformation of the contact form. We illustrate the method by computing lower-bounds for this homology for the case of the standard contact structure of $\mathbb{S}^3$ and for the case of the first exotic contact structure of J.Gonzalo and F.Varela on $\mathbb{S}^3$.

Isabeau Birindelli

Fully nonlinear elliptic equations: Overdetermined boundary conditions and Faber-Krahn inequality.

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We shall consider overdetermined boundary problems for fully nonlinear equations and state in which cases the solution is not trivial. We will emphasize the relationship of these problems with the Faber-Krahn inequality and see some explicite calculations in the two dimensional case.

Marco Bramanti

Fundamental solutions and local solvability for nonsmooth Hörmander's operators

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We consider operators of the form $L = \sum_{i=1}^{n} X_i^2 + X_0$ in a bounded domain of $\mathbb{R}^p$ $(p \geq n+1)$ where $X_0, X_1, \ldots, X_n$ are *nonsmooth* Hörmander's vector fields of step r, such that the highest order commutators are only $C^{1,\alpha}$. Applying Levi's parametrix method we construct a local fundamental solution γ for L, provide growth estimates for γ and its first and second order derivatives with respect to the vector fields and deduce the local solvability of L in $C_X^{2,\beta}$ spaces (for any $\beta < \alpha$).

Luca Brandolini

Liouville type theorems for non-linear differential inequalities on Carnot groups

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Italo Capuzzo Dolcetta

A few recent results on fully nonlinear elliptic equations

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The presentation reports on some results due to the collaboration with Fabiana Leoni (Sapienza Università di Roma) and Antonio Vitolo (Università di Salerno) on viscosity solutions of elliptic partial differential equations of the form

$$F(D^2u) = f(u) - h(x) \tag{1}$$

In the first part of the talk I will discuss local gradient estimates for non-negative solutions of (1) in the spirit of a 2005 paper by Yan Yan Li and Louis Nirenberg. The second part of the presentation focuses on entire solutions of (1) with semilinear term f satisfying a Keller-Osserman type integrability condition.

Giuseppe Di Fazio

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Sorin Dragomir

Subelliptic harmonic maps

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We review results on nonlinear degenerate elliptic systems of PDEs of variational origin e.g. the theory of subelliptic harmonic maps as started by J. Jost and C-J. Xu, [7], together with its geometric in- terpretations (cf. [1], [3]) and further developments (cf. [2], [4], [5], [9], [10]-[12]). A few new results on nonlinear systems of X-elliptic (in the sense of E. Lanconelli and A.E. Kogoi, [8], C. Gutierrez and E. Lanconelli, [6]) equations are also presented.

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Bruno Franchi

Sharp a priori estimates for div-curl systems in Heisenberg groups

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In this Note we present a result proved in collaboration with Annalisa Baldi. We prove a family of inequalities for differential forms in Heisenberg groups $\mathbb{H}^1$ and $\mathbb{H}^2$, that are the natural counterpart of a class of div-curl inequalities in de Rham's complex proved by Lanzani & Stein and Bourgain & Brezis.

Nicola Garofalo

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Christian Gutierrez

Reflector design and the inverse square law

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The intensity of radiation is inversely proportional to the square of the distance from the source. In particular, at large distances from the source, the radiation is distributed over larger surfaces and therefore the intensity per unit area decreases as the distance from the surface to the source increases. We introduce a model to design reflectors that take into account this law and prove existence of solutions. Solutions satisfy Monge-Ampère type equations. This is joint work with Ahmad Sabra.

Guozhen Lu

Sharp Moser-Trudinger and Adams type inequalities in unbounded domains in the spirit of Lions

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In this talk, we will present some recent works on sharp constants for Moser-Trudinger and Adams inequalities on unbounded domains in the spirit of Lions. Sharp affine Moser-Trudinger and Adams inequalities on high oder Sobolev spaces in Euclidean spaces will be described. Applications to nonlinear PDEs with nonlinearity of exponential growth are given. A surprisingly simple method we developed is a rearrangement-free argument which works in the situations where symmetrization is not available (such as high order Sobolev spaces and sub-Riemannian setting). If time allows, results on sharp Moser-Trudinger inequalities on the entire Heisenberg group and stratified groups will be discussed as well. This is joint work with Nguyen Lam and Hanli Tang.

Juan Manfredi

Mean value properties: Old and New

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A classical result states that harmonic functions are characterized by the mean value property over balls or over spheres. In this lecture we explore analogues of this result for p-harmonic functions, solution of the p-Laplace equation,

where the exponent p is finite, $p > 1$. We characterize p-harmonic functions by using asymptotic mean value properties, extending several classical results from the linear case $p = 2$ to other p's. Our characterization extends spaces that are more general than Euclidean. As an application, we will discuss some new uniqueness results for the mean curvature flow in the Heisenberg group. I will mention results jointly obtained with Fausto Ferrari (Bologna), Bernd Kawohl (Cologne), Qing Liu (Pittsburgh), Mikko Parviainen (Helsinki), Julio Rossi (Alicante), and Alexander Sviridov (Nashville).

Enzo Mitidieri

Uniform bounds of solutions of some quasilinear elliptic systems

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Let u be a solution of the system of PDE

$$L(u) = f(u)$$

where L is a quasilinear second order elliptic operator in divergence form. Our aim is to find uniform bounds for all possible solutions u of the system. In this paper we prove some bounds which are universal, they are related to the zeros of the nonlinearity f. Among others, the results apply to Allen-Cahn equation, Ginzburg-Landau systems, Gross-Pitaevskii systems and Lichnerowicz's type equations. Keywords: Quasilinear elliptic systems, a priori estimates, Allen-Cahn equation, Ginzburg-Landau systems, Gross-Pitaevskii systems, Lichnerowicz's type equations.

Enrico Priola

Regularity results for degenerate Ornstein-Uhlenbeck operators and applications to SDEs

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The paper by Bramanti, Cupini, Lanconelli and Priola (Mathematische Zeitschrift, 2010) establishes global L^p-estimates for possibly degenerate Ornstein-Uhlenbeck operators by assuming only a hypoellipticity-type condition. Starting from this result, we prove additional analytic regularity results which allow to get uniqueness for martingale problems associated to Ornstein-Uhlenbeck operators with variable diffusion coefficients.

Patrizia Pucci

Symmetry and multiple solutions for certain quasilinear elliptic problems

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Using a slight modification of the *Pucci* and *Serrin* three critical points theorem, we prove a symmetric version of this result, which we apply to the same abstract eigenvalue problem in order to show the existence of three different symmetric critical points. Then, as a consequence of the main results, we prove the existence of two nontrivial solutions, which are invariant by k–spherical cap symmetrization, $1 \leq k < N$, of quasilinear elliptic Dirichlet problems in either a ball of $\mathbb{R}^N$, or an annulus of $\mathbb{R}^N$, both centered at 0. We also present some existence and multiplicity results.

Sandro Salsa

Regularity issues for two phase free boundary problems with distributed sources.

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We describe some recent results on the regularity of the free boundary for two phase problems governed by non homogeneous elliptic equations. Joint work with Daniela De Silva and Fausto Ferrari.

Susanna Terracini

Segregation problems involving half laplacians Uniform Hölder bounds for strongly competing systems involving standard and anomalous diffusions

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For a class of competition-diffusion nonlinear systems involving s-Laplacian, including the fractional Gross-Pitaevskii system

$$(-\Delta)^s u_i = \omega_i u_i^3 \lambda_i u_i - \beta u_i \sum_{j \neq i} a_{ij} u_j^2, \qquad i = 1, \dots, k,$$

we prove that L^∞ boundedness implies $C^{0,\alpha}$ boundedness for every $\alpha \in [0, 1/2)$, uniformly as $\beta \to +\infty$. Moreover we prove that the limiting profile is $C^{0,1/2}$.

This system arises, for instance, in the relativistic Hartree-Fock approximation theory for k-mixtures of Bose-Einstein condensates in different hyperfine states. This is a joint work with Gianmaria Verzini and Alessandro Zilio.

Achilles K. Tertikas

On the Hardy constant of non-convex planar domains: the case of the quadrilateral

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The Hardy constant of a simply connected domain $\Omega \subset \mathbb{R}^2$ is the best constant for the inequality

$$\int_\Omega |\nabla u|^2 dx \geq c \int_\Omega \frac{u^2}{\operatorname{dist}(x, \partial\Omega)^2}\, dx\ , \qquad u \in C_c^\infty(\Omega).$$

After the work of Ancona where the universal lower bound 1/16 was obtained, there has been a substantial interest on computing or estimating the Hardy constant of planar domains. In this talk I will present new results concerning the case of an arbitrary quadrilateral in the plane.

This talk is based on a joint work with G. Barbatis.

Vincenzo Vespri

Regularity results for degenerate elliptic equations

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In a recent paper with Duzgun and Marcellini we gave a new proof of the solutions to degenerate elliptic equations. This new approach combines DeGiorgi and Moser techniques and we feel that it is more intuitive.