Nonlinear Meeting in Milan 2023
Abstracts

I. BIRINDELLI, *Some degenerate non local operators: regularity and qualitative properties*

In collaboration with Giulio Galise, Erwin Topp, Yannick Sire, we have studied non local operators whose nonlocality is only along some directions and which are non linear and degenerate in the sense that they approximate degenerate elliptic local operators. I will present this theory and in particular some recent results concerning regularity, existence of solutions and classification of solutions.

A. BOSCAGGIN, *The relativistic Kepler problem: a paradigm for dynamical systems and nonlinear analysis*

By using both dynamical systems techniques and variational methods, we discuss existence and multiplicity of periodic solutions of (forced) relativistic Kepler problems in the plane. Joint works with W. Dambrosio (Torino), G. Feltrin (Udine) and D. Papini (Modena e Reggio Emilia).

M. GARAVELLO, *Control and Optimization for Traffic Flow*

In the last years, starting with the seminal papers by Lighthill and Whitham [4] and Richards [5], there was an increasing interest in conservation laws for the modeling and management of traffic flow in road networks, mainly justified by applications. A particular attention was devoted to control problems, mainly with the aim of reducing congestions, car accidents, and pollution.

In the talk we present some possible ways for controlling traffic flow when described by the first order macroscopic Lighthill-Whitham-Richards (briefly LWR) model. More precisely, we consider a control function acting at the level of junctions [1] and through special vehicles [3]. We discuss about the concept of solution and we show that, for every choice of the control function, the solution exists and that, in some cases, the input-output map is continuous. We also consider the problem of minimizing functionals describing traffic performance indexes, already proposed in the literature, and we show the existence of optimal solutions [2].

[1] F. Ancona, A. Cesaroni, G. M. Coclite, M. Garavello. On the optimization of conservation law models at a junction with inflow and flow distribution controls. *SIAM J. Control Optim.* 56 (2018), no. 5, pp. 3370–3403.

[2] F. Ancona, A. Cesaroni, G. M. Coclite, M. Garavello. On optimization of traffic flow performance for conservation laws on networks. *Minimax Theory Appl.* 6 (2021), no. 2, pp. 205–226.

[3] M. Garavello, P. Goatin, T. Liard, B. Piccoli. A multiscale model for traffic regulation via autonomous vehicles. *J. Differ. Equations* 269 (2020), no. 7, pp. 6088-6124.

[4] M. J. Lighthill, G. B. Whitham. On kinematic waves. II. A theory of traffic flow on long crowded roads. *Proc. Roy. Soc. London. Ser. A.* 229 (1955), pp. 317-345.

[5] P.I. Richards. Shock waves on the highway. *Operations Res.* 4 (1956), pp. 42-51.

S. MARÒ, *On the dynamics of exact symplectic twist maps*

We will describe some techniques to study invariant sets of symplectic twist maps in the framework of Aubry-Mather and KAM theories. As an example we will study the dynamics of a bouncing ball problem.

F. SANI, *On the existence of maximizers for second order Adams type inequalities on balls*

This talk will focus on the problem of the existence of maximizers for Adams' inequalities on second order Sobolev spaces with Navier boundary conditions on balls in any dimension $n > 3$. In particular, we show how the well-known ideas introduced in the study of the analogous problem for the first order Trudinger-Moser inequality on balls help to reach the second order framework with Navier boundary conditions. We also discuss some sharp weighted versions of Adams' inequality on the same spaces. Since the weights that we consider determine a supercritical exponential growth (except in the origin), the corresponding inequalities hold for spherically symmetric functions only and, as in the unweighted case, they are attained.

G. VAIRA, *Segregated solutions for nonlinear Schrödinger systems with weak interspecies forces*

In this talk we discuss about the existence of positive non-radial solutions for a system of Schrödinger equations in a weak fully attractive or repulsive regime in presence of an external radial trapping potential that exhibits a maximum or a minimum at infinity. Moreover, we also consider the critical growth case.