Nonlinear Phenomena in Mathematical Physics and Applications

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Abstracts

Francisco Javier Chinea, *Universidad Complutense de Madrid, Spain*

On É. Cartan's first paper

Abstract. In his amazingly short very first paper, announcing a result of his Ph. D. Thesis, Élie Cartan identified the exceptional Lie group G_2 with the group of contact transformations leaving invariant a system of two nonlinear, second-order partial differential equations.

Ramón Fernández Álvarez-Estrada, *Universidad Complutense de Madrid, Spain*

La trayectoria de Luis Martínez Alonso: una breve perspectiva

Abstract. Se recorre la doble trayectoria (académica y científica) del Prof. Luis Martínez Alonso. Se intentará hacer una evocación de aquella en el contexto en el que ha tenido lugar, desde su comienzo hasta la actualidad, con más o muy poco detalle, según las etapas (y las posibilidades de este ponente). Tampoco será posible ofrecer una descripción mínimamente detallada del conjunto de sus contribuciones científicas, salvo de unas pocas. Afortunadamente, otros participantes en este encuentro lo podrán hacer de forma mucho más adecuada.

Pilar García Estévez, *Universidad de Salamanca, Spain*

Integrability and soliton solutions for a nonlinear model of spin transport in helical molecules

Abstract. We study an effective integrable nonlinear model describing an electron moving along the axis of a deformable helical molecule. The helical conformation of dipoles in the molecular backbone induces an unconventional Rashba-like interaction that couples the electron spin with its linear momentum. In addition, a focusing nonlinearity arises from the electron-lattice interaction, enabling the formation of a variety of stable solitons such as bright solitons, breathers, and rogue waves. A thorough study of the soliton solutions for both focusing and defocusing nonlinear interaction is presented and discussed.

Luis Manuel González-Romero, *Universidad Complutense de Madrid, Spain*

The inverse problem in neutron star theory: listening the equation of state

Abstract. We present an approach to the inverse problem for relativistic stars using the mass and quasinormal modes or mass and the tidal deformability. We apply an algorithm based in a piecewise polytropic meshing and refinement method. We reconstruct the neutron star equation of state from input data.

Alberto Ibort, *Universidad Carlos III de Madrid-ICMAT, Spain*

Group(oid)-theoretical foundations of classical and quantum mechanics

Abstract. Groupoids provide a natural framework to describe quantum systems as well as classical mechanical ones. We will briefly review some of the main ideas involved in this approach comparing them with the ideas discussed by L. Martínez-Alonso in the papers with the same title published more than 40 years ago.

Boris Konopelchenko, *Università del Salento, Lecce, Italy*

Multi-dimensional Jordan chain and Navier-Stokes equation

Abstract. Multi-dimensional Jordan chain is presented. It is shown that it admits the finite-component reductions to the Navier-Stokes equation and other important equations of continuous media theory.

Franco Magri, *Università di Milano "Bicocca", Italy*

Newton and the central equation of mechanics

Abstract. The purpose of the talk is to revive the interest towards an equation, called the Central Equation of Dynamics by the great mechanicians of the XIX century, which has been lost in the process of giving new geometrical foundations to Mechanics pursued in the second half of the XX century, thus disappearing from all the modern texts of Mechanics.

Francisco Marcellán, *Universidad Carlos III de Madrid, Spain*

Sobolev orthogonal polynomials and boundary value problems for Schrodinger equations with polynomial potentials

Abstract. In this lecture we focus our attention on sequences of polynomials orthogonal with respect to a weighted Sobolev inner product with measures supported on the real line. Structural and analytic properties of such polynomials are presented. An application to spectral methods for boundary value problems for Schrödinger equations with polynomial potentials are studied. The comparison with the standard methods based on classical orthogonal polynomials as well as some open problems will be discussed.

Juan Carlos Martínez, *Universidad de Barcelona, Spain*

Sobre algoritmos, máquinas de Turing y complejidad

Abstract. En primer lugar, mostraremos el concepto de máquina de Turing, que es la formulación matemática más conocida del concepto intuitivo de algoritmo. Utilizando entonces las máquinas de Turing, definiremos las principales clases de complejidad y mostraremos algunos problemas abiertos sobre ellas.

Mariano A. del Olmo, *Universidad de Valladolid, Spain*

Symmetry Groups, Quantum Mechanics and Generalized Hermite Functions

Abstract. In this communication a generalisation of Euclidean and pseudo-Euclidean groups is presented. Also the well known in quantum mechanics Weyl-Heisenberg group is involved. A new family of groups is obtained including the above mentioned groups as subgroups. Properties like self-similarity and invariance with respect to the orientation of the axes are properly included in the structure of this new family of groups. Generalized Hermite functions on multidimensional spaces, which serve as orthogonal bases of Hilbert spaces supporting unitary irreducible representations of these new groups, are introduced. By extending these Hilbert spaces, we obtain representations on rigged Hilbert spaces.

Juan Luis Vázquez, *Universidad Autónoma de Madrid and Real Academia de Ciencias, Spain*

Nonlinear PDEs in Madrid since 1980. A personal perspective

Abstract. I will try to present a personal recollection of the nonlinear PDEs in which I was involved since 1976 in UCM and then in UAM and the world; the hard work, the good company we found, and the many adventures we lived.
