XVIII International Fall Workshop on Geometry and Physics

Benasque, September 6–11, 2009

POSTERS

RUI LOJA FERNANDES AND PEDRO FREJLICH
Instituto Superior Tecnico

h-principles in Poisson Geometry

We formulate a sufficient cohomological criterion for a regular almost-Poisson structure on an open manifold to be homotopic to a regular Poisson one.

RICARDO GALLEGO TORROME
University of Lancaster

There are no Strictly Landsberg Surfaces

We show that there are not pure $\mathcal{C}^5$ regular y-global Landsberg surfaced. The proof is based on the averaged connection associated with the linear Chern's connection and the classification of irreducibles holonomies of torsion-free affine connections. It consists on exausting all the possible cases and showing that in dimension 2 Landsberg condition implies Berwald condition.

LEONARDO COLOMBO
ICMAT-CSIC and Universidad Nacional de La Plata

A Survey of Optimal Control for Underactuated Mechanical Systems in Quasivelocities

Quasivelocities are the components of a mechanical system?s velocity relative to the set of vector fields that span the fibres of the tangent bundle of the configuration space. These vector fields need not be associated with (local) configuration coordinates.

A good example of quasivelocities is the set of components of the body angular velocity of a rigid body rotating about a fixed point. One of the reason for using quasivelocities is that the Euler-Lagrange equations written in generalized coordinates are not effective for analyzing the dynamics of a mechanical systems of interest.

In this poster we use the quasivelocities for the analyzed of the underactuated mechanical control systems.

RICARDO GALLEGO TORROME
University of Lancaster

Averaged Lorentz Dynamics and Comparison with Standard Lorentz Dynamics

A geometric formulation of the Lorentz law as the differential equations for auto-parallel integral curves of a linear connection ${}^L\nabla$ is presented. We define an associated covariant derivative also denoted by ${}^L\nabla$. Then, we use an averaging procedure to obtain the *averaged connection* and the associated *averaged dynamics*. This *averaged dynamics* is simpler than the original one. We proof also that in the ultra-relativistic limit and for concentrated 1-particle probability distributions, the auto-parallel curves of the averaged connection remain close to the auto-parallel curves of ${}^L\nabla$.

A. HURTADO AND C. ROSALES
Universidad de Granada

Stability of constant mean curvature surfaces in the sub-Riemannian three-sphere

In this work, we study first and second order minima of the area under volume-constraint in the sub-Riemannian three-sphere.

RAFAEL M. RUBIO RUIZ
Universidad de Córdoba

Uniqueness of constant mean curvature surfaces inmersed in a slab in certain 3-dimensional Robertson-Walker spacetimes and Calabi-Bernstein type problem

Several uniqueness results for the spacelike slices in certain Robertson-Walker spacetimes are proved under boundeness assumptions either on the mean curvature function of the spacelike surface or on the restriction of the time coordinate on the surface when the mean curvature is constant. In the non-parametric case, a uniqueness result and a non-existence one are proved for bounded entire solutions of some constant mean curvature spacelike differential equations.

S. VILARIÑO, J.C. MARRERO, N. ROMÁN-ROY AND M. SALGADO
Uiversidad de Santiago de Compostela

Symmetries, Noether's theorem and reduction in k-cosymplectic field theories

The k-cosymplectic formulation provides us with a very appropriate and simple geometric framework for working with certain kinds of field theories, both in the Lagrangian and the Hamiltonian formalisms. Using this framework, we introduce a class of symmetries for Hamiltonian k-cosymplectic fiels theories, and study their associated conservation laws by means of a suitable generalization of Noether's theorem. For these symmetries, we propose also a geometric reduction procedure which is based on the Marsden-Weinstein reduction theorem.

Antonio Otal and Luis Ugarte
Universidad de Zaragoza

Special metrics and hypo contact structures on product Lie groups

We classify product Lie groups admitting hypo structures with compatible contact form. We evolve such structures according to Conti-Salamon evolution equations to construct Riemannian metrics with holonomy equal to $SU(3)$.

Rafael Ramirez and Natalia Shadovskaia
Universitat Rovira i Virgili

Cartesian approach to constrained mechanical systems with three degree of freedom

In the history of mechanics, there have been two points of view for studying mechanical systems: The Newtonian and the Cartesian. According the Descartes point of view, the motion of mechanical systems is described by the first-order differential equations in the N dimensional configuration space Q. In this paper we develop the Cartesian approach for mechanical systems with three degrees of freedom and with constraint which are linear with respect to velocity. The obtained results we apply to discuss the integrability of the geodesic flows on the surface in the three dimensional Euclidian space and to analyze the integrability of a heavy rigid body in the Suslov and the Veselov cases.

Alexander Shermenev
Russian Academy of Sciences

Wave equation in cylinder coordinates

An interaction of two acoustical waves in a cylinder is studied within quadratic approximation. When the cylinder coordinates are used, the usual perturbation techniques in separation of variables method inevitably lead to a series of overdetermined systems of linear algebraic equations for the unknown coefficients (in contrast with the Cartesian coordinates). However, if we formally introduce a new function satisfying the first system of this series, all these overdetermined systems become compatible (remaining overdetermined) for the special case of the nonlinear acoustical wave equation. Using the new function and quadratic polynomials of the Bessel functions of radius, we explicitly express the coefficients of the resulting harmonics. It gives solutions describing two-waves interaction which are found with the same accuracy as the nonlinear acoustical equation is derived. As a consequence, a general boundary problem can be explicitly solved in these terms.

References:

[1] Shermenev, A. *Nonlinear acoustic waves in tubes* Acta Acustica, vol. 89 (2003) 426–429.

[2] Shermenev, A. *Separation of variables for the nonlinear wave equation in cylindrical coordinates* Physica D: Nonlinear Phenomena, 212:3-4 (2005) pp 205-215.

Cédric Martínez Campos
ICMAT - CSIC

Higher-Order Classical Field Theory

We propose a differential-geometric setting for the dynamics of a higher-order field theory, based on the Skinner and Rusk formalism for mechanics. This approach incorporates aspects of both, the Lagrangian and the Hamiltonian description, since the field equations are formulated using the Lagrangian on a higher-order jet bundle and the canonical multisymplectic form on its affine dual. The result is that we obtain a unique and global intrinsic description of the dynamics.