CONGRESO DE JÓVENES INVESTIGADORES
Real Sociedad Matemática Española
Universidad de Murcia, del 7 al 11 de Septiembre de 2015

k-symplectic Lie systems and applications

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The main aim of this talk is to show that k-symplectic structures can naturally be employed to investigate ordinary differential equations instead of field theories. This leads to endow k-symplectic structures with new geometric useful constructions and to recover notions that were previously ignored because they are not appropriate for field theories.

To illustrate above claims, I will first survey k-symplectic structures and Lie systems, namely systems of ordinary differential equations whose general solutions can be described as a function, the superposition rule, of a family of particular solutions and some constants. Lie systems are equivalent to curves in a finite-dimensional Lie algebra of vector fields. In the so-called k-symplectic Lie systems [1], the Lie algebra can be chosen to consist of Hamiltonian vector fields with respect to a k-symplectic structure. This suggests us to endow k-symplectic structures with a Lie algebra of admissible functions and several related Poisson algebras. These Lie algebras give rise, through a Poisson-coalgebra approach, to methods to derive geometrically superposition rules for k-symplectic Lie systems.

Our theory will be illustrated with examples from control theory, physics and mathematics [1, 2]. If time permits, I will give some hints about the extension and applications of previous results to multisymplectic and poli-Dirac structures.

Referencias

[1] J. de Lucas and S. Vilariño: k-symplectic Lie systems: theory and applications, *J. Differential Equations* **258** (6) (2015) 2221–2255.

[2] J. de Lucas, M. Tobolski and S. Vilariño: A new application of k-symplectic Lie systems, *Int. J. Geom. Methods Mod. Phys.* (2015) 1550071.