# The Second Summer School on the

# Geometry of Differential Equations

## September 9–13, 2013

Organized by the Mathematical Institute of Silesian University in Opava, the school is the second in a series supported by the European Social Fund under the project CZ.1.07/2.3.00/20.0002 (see `http://projects.math.slu.cz/RVKMU/`).

## Scientific Programme

The following two parallel courses will take place during the summer school.

**Basic course.** Conservation laws - theory and computation (*Raffaele Vitolo,* University of Salento, and *Giovanni Moreno,* Silesian University in Opava)

1. Definition of jet space and its Cartan distribution
2. Differential equations and their Cartan distribution; symmetries
3. Horizontal forms, horizontal differential, horizontal de Rham cohomology on jet spaces
4. Geometric theory of conservation laws
5. Correspondence of a conservation law with a uniquely defined vector function, the generating function of the conservation law: theoretical aspects
6. Examples of computations
7. Elements of calculus of variations with differential forms; Noether's theorem
8. Variational equations and correspondence between symmetries and conservation laws
9. Integration of ODEs by quadratures using symmetries and conservation laws
10. The method of characteristics and integration of first-order PDEs
11. Computation of conservation laws, also by the use of specialized symbolic software

**Advanced Course.** Poisson Structures (*Joseph Krasil'shchik,* Silesian University in Opava and Moscow Independent University, and *Alexander Verbovetsky,* Moscow Independent University)

1. Symplectic and Poisson manifolds
2. The Schouten bracket
3. Finite-dimensional Hamiltonian formalism. Integrability
4. Infinite jets and infinite prolongations of PDEs
5. Cartan distribution and symmetries
6. Horizontal and Cartan forms. Conservation laws
7. $\mathcal{C}$-differential operators. Adjont operators. The Green formula
8. The Euler operator. Cosymmetries
9. Variational bivectors. Variational Poisson structures
10. The variational Schouten bracket
11. Compatible Poisson structures. The Magri scheme
12. Coverings. Nonlocal symmetries and shadows. Bäcklund transformations. Tangent and cotangent coverings
13. Poisson structures as shadows of symmetries in the cotangent covering
14. Variational forms. Variational symplectic structures
15. Symplectic structures as shadows of cosymmetries in the tangent covering
16. Variational Poisson and symplectic structures as Bäcklund transformations between tangent and cotangent coverings
17. Examples

The basic course is aimed at the beginners, with the pace and style of presentation to match. The advanced course is aimed at the students who are already familiar with the contents of the basic course.

The courses will provide students with a comprehensive presentation of the respective subjects, and introduce them to the basic motivations, methods and results of the relevant fields of study. The participants will also be informed about open problems in the field.

## Organization

The summer school will take place in Kouty nad Desnou in the Jeseníky mountains at the Hotel Dlouhé Stráně (`www.hotelds.cz`), Czech Republic, and will last for five days with a total of 36 academic hours of morning lectures and afternoon training sessions. The teaching will be in English. In the course of the training sessions, the participants will solve problems and submit their solutions. The instructor will provide advice and feedback on these if need be. Included will be short tutorials to use the software for the computer-aided calculations.

The successful participants will receive a certificate; the latter will be awarded on the basis of performance at the training sessions.

## Costs

A small number of scholarships for the Czech participants is available. The individual support will cover full board and lodging during the summer school period as well as the associated travel expenses. We especially encourage doctoral students from the Czech Republic to apply for these scholarships during the registration process.

International participants will pay subsistence costs (accommodation and meals) on their own.

## Registration

Please contact the organizers at school-gde@math.slu.cz as soon as possible, because of limited capacity of the school.