Mathematisches
Forschungsinstitut
Oberwolfach

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Oberwolfach Seminar

Introduction to Convex Integration

Organizers: Daniel Faraco, Madrid
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Date (ID): 23 – 29 May 2021 (2121b)
Deadline: 11 April 2021

Convex integration is a technique for the construction of solutions to certain nonlinear systems of partial differential equations. The technique originates in the work of John Nash 1954 on C^1 isometric embeddings and has been developed into a powerful general method in Gromov's book for certain problems in differential geometry. The key condition for applicability of the method in Gromov's framework is "ampleness" of the differential relation – however, this condition excludes most PDE systems arising in classical physics.

In the last decade new versions of this technique have been developed primarily for applications in fluid mechanics. Most notable achievements are (1) the non-uniqueness of weak solutions to the incompressible Euler system and to the p-system of compressible ideal flows; (2) the resolution of Onsager's conjecture on anomalous dissipation in the context of the K41 theory of turbulence; and (3) the non-uniqueness of distributional solutions of the Navier-Stokes equations and of distributional solutions of the linear transport equation with Sobolev vectorfields.

The analytical techniques differ substantially: in (1) the key issue is a plane-wave analysis in the style of L. Tartar and the application of Baire category arguments; in (2) the technical difficulty is to construct solutions with strong uniform bounds on the approximating sequence and its derivatives which requires in particular special care of the linear (transport) part of the errors; in (3) an additional concentration term simplifies the "linear part" of the error (a major issue in (2)) but leads to additional problems when trying to achieving "optimal" intermittency. The lectures aim to provide an exposition to these separate issues and to address the corresponding developments at the forefront of this still emerging theory.

The seminar takes place at the Mathematisches Forschungsinstitut Oberwolfach. The Institute covers board and lodging. By the support of the Carl Friedrich von Siemens Foundation travel expenses can be reimbursed up to 150 EUR in average per person (against copies of travel receipts). The number of participants is restricted to 25.

Applications including

- full name and address, incl. e-mail address
- short CV and publication list
- present position, university
- name of supervisor of Ph.D. thesis
- a short summary of previous work and interest
- title, ID and date of the intended seminar

should be sent preferably by e-mail (with attachments in pdf format) via **seminars@mfo.de** until 11 April 2021 to:

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