Systems of conservation laws in one space variable

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Timetable: 16 hrs. First lecture on April 10, 2018, 11:00 (dates already fixed, see the calendar), Torre Archimede, Room 2BC/30.

Course requirements: very basic notions of PDE theory (definition of distributional solution, definition of Sobolev space).

Examination and grading: seminar

SSD: MAT/05 - Mathematical Analysis

Aim: the course aims at providing an introduction to the analysis of systems of conservation laws in one space variable. Although due to time constraints I will mostly focus on the scalar case, I will introduce techniques that have been successfully applied to the case of systems.

Course contents: I will discuss existence and uniqueness results for systems of conservation laws in one space variable. Systems of conservation laws are partial differential equations with several applications coming from both physics and engineering, in particular from fluid dynamics and traffic modeling. Despite recent progress, the mathematical understanding of these equations is still largely incomplete and many fundamental problems are presently open. For instance, no well-posedness theory is presently available for systems of conservation laws in several space variables. The tentative schedule is as follows.

- Classical solutions, the theory of characteristics.
- Distributional solutions, Rankine-Hugoniot conditions.
- Admissibility criteria for distributional solutions. The solution of the Riemman problem.
- Existence of global in time, admissible distributional solutions. The wave-front tracking algorithm.
- Initial-boundary value problems.