AN INTRODUCTION TO SYSTEMS OF CONSERVATION LAWS

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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. In particular, no general well-posedness theory is presently available for systems of conservation laws in several space variables.

The scope of this course is twofold: first, highlight the main challenges in the analysis of conservation laws (finite time breakdown of classical solutions, non uniqueness of distributional solutions, ...). Second, introduce some of the main technical tools that have been used in the analysis of this class of equations (the vanishing viscosity approximation, the Riemann problem, ...).

The tentative schedule is as follows.

- Introduction and examples
- Classical solutions, the theory of characteristics.
- Distributional solutions, Rankine-Hugoniot conditions.
- The entropy admissibility criterion. Existence and uniqueness results for scalar equations.
- Initial-boundary value problems.

Main References


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