Nonlinear Partial Differential Equations

Spring 1998
MW 2:00pm – 3:10pm
Lunt 102

Instructor: Konstantina Trivisa

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Outline:

A. Hyperbolic Conservation Laws

- Single conservation laws, $u_t + f(u)_x = 0$.
- Weak solutions, Rankine-Hugoniot condition.
- Systems of conservation laws.
- The Riemann problem. The random choice method of Glimm.
- Entropy admissibility criteria (characterization of "good" solutions).
- The space of functions of bounded variation BV.
- Generalized characteristics in hyperbolic systems of conservation laws.
- Hamilton Jacobi equations. Viscocity solutions.

B. Compensated Compactness

- Young measures – The Div-Curl lemma.
- Applications to hyperbolic conservation laws.
- Elements from nonlinear Elasticity – Continuum Mechanics.
- Polyconvexity – Involutions. (optional)

C. Selected Topics

- Kinetic theory – Homogenization.

References

- Generalized Characteristics in Hyperbolic Systems of Conservation Laws. *C. M. Dafermos* (A series of research papers and lecture notes – Brown University)
- Weak Convergence Methods for Nonlinear Partial Differential Equations *L. C. Evans* AMS **74**.
- Berkeley Lecture Notes on Partial Differential Equations *L. C. Evans*
- Hyperbolic Systems of Conservation Laws and the Mathematical Theory of Shock waves. *P. D. Lax* (Regional Conference Series in Applied Mathematics)
- Shock Waves and Reaction – Diffusion Equations. *J. Smoller* (Springer Verlag)
- Compensated Compactness and Applications to Partial Differential Equations. *L. Tartar* (Nonlinear analysis and mechanics: Heriot-Watt Symposium, Vol. IV, pp. 136–212.)
- A series of research papers by G. Q. Chen, R. DiPerna, J. Glimm, P. D. Lax and T.-P. Liu.

More references will be given during lectures.

Prerequisite:
Some basic knowledge of partial differential equations (D26 – D27) is recommended but not required.

There will be no final exam.

Office hours: By appointment.