

Nonlinear first- and second-order partial differential equations: viscosity methods and homogenization theory

Prof. Panagiotis Souganidis¹, Prof. Martino Bardi², Prof. Pierpaolo Soravia²

¹*Department of Mathematics
University of Chicago (USA)
Email: souganidis@math.uchicago.edu*

²*Università di Padova
Dipartimento Dipartimento di Matematica Pura ed Applicata
Email: {bardi,soravia}@math.unipd.it*

Timetable: 22 hours + seminars. The first lecture will be on Wednesday, March 23, 2011, Torre Archimede, 2AB/40. Class meets on Wednesday and Friday from 10:30 to 12:30 up to April 20, and from 14:00 to 16:00 on April 29 and on May 5, 2011. After the first part of the course, Prof. Souganidis will give some seminars on the subject. The Room of the course is 2BC/30, except on March 23, 2011 (2AB/40) and on April 15 and May 5, 2011 (Meeting Room, VII floor, stair B).

The last lecture of the first part will be given on May 10, from 11:30 to 13:00, Room 2BC/30.

Course requirements: Advanced calculus and basic real analysis.

Examination and grading: Oral presentation of one of the topics of the course after some additional reading.

SSD: MAT/05 Mathematical Analysis

Aim: The course consists in two parts. In the first part, Prof. Bardi and Prof. Soravia will present an introduction to the viscosity methods and they will develop the homogenization theory, while in the second part Prof. Souganidis will give some seminars.

Course contents:

Part 1: (22 hours) Introduction to the viscosity methods. Basic examples of fully nonlinear PDEs: Hamilton-Jacobi equations, Bellman-Isaacs equations of stochastic optimal control, equations of Monge-Ampère type arising in optimal mass transportation and in differential geometry, propagation of moving fronts by the level set method. Viscosity solutions of first-order and degenerate elliptic second-order equations: elementary properties, well-posedness of the Dirichlet and Cauchy problems, relaxed semi-limits. Homogenization theory. The course will be about the homogenization theory nonlinear first- and second-order PDEs in periodic, almost periodic and random (stationary ergodic) media.

Part 2: (4 hours) Seminars.