Partial Differential Equations: Theory and Numerical Methods

International Autumn School
for Graduate and PhD students
University of Novi Sad, October 16-19, 2014

Lecturers:

Marko Nedeljkov, professor, University of Novi Sad, marko@dmi.uns.ac.rs
Mónika Van Leeuwen-Polner, assistant professor, University of Szeged, polner@math.u-szeged.hu

Length: 24 hours (10 hours lecture, 14 hours practice in computer laboratory

Web: http://www.dmi.uns.ac.rs/ipa/index.html#!home
www.model.u-szeged.hu (menu: Education)

Language: English

Audience: Mathematics, Physics, Chemistry graduate and PhD student are preferred but other fields are also welcome

Prerequisites: Courses of master level on differential and difference equations, knowledge of MATLAB at basic level.

Conditions:

- Participation is free, supported by the IPA HUSRB/1203/221/024 projects "Non-Standard Forms of Teaching Mathematics and Physics". Participants have to mention this support when the participation is referred.
- Participants can bring their laptops with MATLAB installed.
- The organizers try to support the accommodation for the participants, with priority for students from the HU-SRB cross-border region.
- Travelling expenses are covered by the participants

Method of practices: The participants and the lecturer work on computer simultaneously. In every topic, a short introduction and description are followed by solving practical problems and developing applications with MATLAB.

Tentative Program

The schedule of the program below can change according to the special interest of the audience.

October 16, Thursday, 16.00 - 18.00

Introductory talks. Explanation of the course goals, preliminary reading of the teaching material. Interview of students.

October 17, Friday

Morning session, 08.30 - 12.00

Analytic classical theory. Basic physical models, the wave and heat equation will be the main examples. Existence of solutions, a priori estimates (energy integrals, maximum principle). Communication with students concerning their previous knowledge.

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Afternoon session, 14.00 - 18.00

Basic numerics. Introduction to Matlab, with illustrative examples. Functions and scripts programming, Matlab graphics. Numerical solutions of ODEs. Numerical algorithms for the heat and wave equations: an explicit, an implicit and the Crank-Nicolson method. Student exercises.

October 18, Saturday

Morning session, 08.30 - 12.00

Linear and nonlinear PDEs. Sobolev spaces, weak solutions. Existence and some standard procedures for the wave and heat equations. Simple nonlinear equations (transport ones) trough simple modeling.

Afternoon session, 14.00 - 18.00

Numerical methods for PDEs. Numerical algorithms for first order PDE's. A finite difference scheme for nonlinear conservation laws. Introduction to finite element methods through some examples (Heat equation). Student exercises.

October 17, Saturday

Morning session, 08.30 - 13.00

Student presentations and discussion. Students will present results of their group work.

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