Piecewise Smooth Dynamical Systems

PhD course

Technical University of Denmark,
Department of Applied Mathematics and Computer Science

Date

5th May – 9th May, 2014

Location

Technical University of Denmark, Kgs. Lyngby (Copenhagen), Denmark. http://www.dtu.dk/english

Course Description

Mechanical systems with impacts and friction, biological systems with thresholds and social systems with limiting factors are all examples of piecewise smooth systems. To the mathematician, they are fascinating and challenging, since they call into question the very notion of the solution to a differential equation. In applications, they are vital to the understanding of control systems, gene regulation and all sorts of mechanical systems. In fact, piecewise smooth system contain not only classical nonlinear behavior such as bifurcations and chaos, but also unique dynamics such as sliding and period adding bifurcations that are seen in applications. Yet, despite their ubiquity, surprisingly little is known about the dynamics of these systems.

In this course, we shall consider many topics, which will give a flavour of the large range of unsolved problems in this field. We will start with the basics, covering piecewise smooth maps and flows, then look at some modeling and mathematical challenges, consider numerical methods and smoothing and bring students right up to date with the classification of sliding bifurcations and the use of Melnikov methods. Students should have a basic background in dynamics (for example, a familiarity with topics in Strogatz's book Nonlinear Dynamics and Chaos would be useful), and may be interested in applications.

Course Homepage

http://www2.mat.dtu.dk/people/M.Brons/piecewise/

Lecturer

Professor John Hogan, Bristol University, UK, currently Otto Mønsted Guest Professor at the Technical University of Denmark.

Organizer

Morten Brøns, Department of Applied Mathematics and Computer Science, Technical University of Denmark.

Participants

The course is designed for Ph.D.-students and final-year graduate students being familiar with the basic concepts of dynamical systems.

Working Load

The course gives 5 ECTS corresponding to approximately 130 hours in total, which includes work during the course period at DTU (lectures, exercises, and discussions) as well as project work after the course week.

Study Material

Course material will be provided to the participants.

Language

All lectures will be given in English.

Evaluation

To pass the course, active participation in all activities is required; this includes discussions, exercises, and project work. A project report must be handed on the 1st of June 2014. The course is passed/not passed. ECTS points: 5.

Registration

Anne Mette Eltzholtz Larsen, Department of Applied Mathematics and Compute Science, Technical University of Denmark, Building 303B, DK-2800 Kgs. Lyngby, Denmark. Phone: (+45) 4525 5246, E-mail: amel@dtu.dk.

Registration Fee

There is a no registration fee for students enrolled at universities and public research institutions.

Registration

Applicants should submit a request for registration by e-mail to amel@dtu.dk. Registration is on a first-come-first-served basis. Max 25 participants.

Housing

Participants are requested to arrange their own accommodation. See the homepage for suggestions.

Support

This course is supported by the PhD-school ITMAN and The Otto Mønsted Foundation.

Updates

Watch the homepage for updates and further information: