Winter Workshop "Dissipation and Dispersion in Nonlinear PDEs"
January 16-17, 2014 at Schloss Hernstein

Schedule

Wednesday, January 15

Until 17:00	Arrival
17:30-18:00	Student meeting: *Election of spokes person*
18:30-19:30	Dinner

Thursday, January 16

07:30-09:00	Breakfast
09:00-09:45	Ilaria Perugia: *Non standard finite element methods*
09:50-10:35	Dirk Praetorius: *Coupling and numerical integration of the Landau-Lifshitz-Gilbert equation*
10:40-11:10	Coffee break
11:10-11:55	Ulisse Stefanelli: *Global-in-time variational methods*
12:30-13:30	Lunch
14:00-14:45	Gerald Teschl: *Peakon asymptotics for the dispersionless Camassa-Holm equation*
14:50-15:35	Rada Weishäupl: *Two-component nonlinear Schrödinger system with linear coupling*
15:40-16:00	Coffee break
16:00-16:45	Marie-Thérèse Wolfram: *Crowd motion: from modeling to simulations*
16:50-17:50	Student meeting: *Impressions on DK, organization of student activities*
17:50-18:20	Faculty meeting: *Feedback from spokes person*
18:30-19:30	Dinner

Friday, January 17

07:30-09:00	Breakfast
09:00-12:15	Presentation techniques I (Martin Buxbaum)
12:30-13:30	Lunch
13:30-16:45	Presentation techniques II (Martin Buxbaum)
17:00	Departure

Abstracts

Ilaria Perugia

Non standard finite element methods

Over the last years, new finite element methods based on non conforming and/or non polynomial approximating spaces have been developed in order to better reproduce physical properties of the analytical solutions, and to enhance stability and approximability. In this presentation, we will focus on discontinuous Galerkin methods and on operator-adapted finite elements. Discontinuous Galerkin methods are based on approximating spaces made of completely discontinuous functions. They provide a general setting where some properties of the continuous problem (e.g., mass conservation, positivity of solutions) can be preserved in the numerical solution, in addition to allowing for a flexible mesh design.

Operator-adapted finite elements consist of inserting information about the differential operator into the approximating spaces, by using trial and/or test spaces locally spanned by solutions to the PDE (Trefftz spaces). This improves the accuracy vs. computational cost with respect to standard finite element methods and, in the case of highly oscillatory solutions, breaks the strong requirements on number of degrees of freedom per wavelength to ensure stability.

Dirk Praetorius

Coupling and numerical integration of the Landau-Lifshitz-Gilbert equation (LLG)

In our talk, we give an overview on reliable numerical methods for the numerical integration of LLG. We shall discuss the existence of weak solutions to LLG if LLG is coupled to yet another PDE, e.g., the full Maxwell system. Emphasis is put on an effective numerical treatment, where the time-marching schemes decouples the numerical integration of LLG and the Maxwell system.

Ulisse Stefanelli

Global-in-time variational methods

I intend to overview some global-in-time variational techniques for evolution equations. In particular, we shall be interested in the possible reformulation of evolution systems, either of dissipative or dispersive type, in terms of minimization problems. The idea is that of moving the successful machinery of the Calculus of Variations (direct method, gamma-convergence, relaxation…) to evolutionary situations. I will mention the celebrated Brezis-Ekeland-Nayroles and De Giorgi principles as well as the more recent WIDE principle.

Gerald Teschl

Peakon asymptotics for the dispersionless Camassa-Holm equation

I will discuss a novel method (developed in collaboration with Jonathan Eckhardt) for establishing the long-time asymptotics of integrable wave equations in the special case where the underlying isospectral has purely discrete spectrum. Specifically we will use the example of the dispersionless Camassa-Holm equation, and show that initial conditions with integrable momentum asymptotically split into a sum of peakons as conjectured by McKean. Surprisingly, this new method is very elementary and only requires some complex analysis.

Rada Weishäupl

Two-component nonlinear Schrödinger system with linear coupling

We consider a system of two nonlinear Schrödinger equations, which are coupled through a linear term in addition to the nonlinearity. We are interested in the long-time behavior and blow-up alternative of this system with and without a damping term. In particular we want to understand the effect of the linear coupling in this setting.

Marie-Thérèse Wolfram

Crowd motion: from modeling to simulations

The dynamic motion of large human crowds is an ubiquitous phenomena in everyday life. First empirical studies on crowd motion started in the late 1950ties and spread into different fields like transportation research, psychology or urban and regional planning. Recently there has been a strong interest in crowd motion within the mathematical community, which initiated a lot of research on mathematical models, their analysis and simulations.

In this talk we focus on a fast exit scenario and consider a group, which wants to leave a room as quickly as possible. We present different modeling approaches, starting on the microscopic level and working our way up to the appropriate continuum limits. In particular we focus on Hughes model for pedestrian flow and give an interpretation from the mean field game perspective. Finally we discuss different challenges in the analysis and numerical simulations and illustrate the behavior of the presented models with numerical simulations.

General Information

How to reach Schloss Hernstein:

Take the local train from Wien Meidling to Leobersdorf (about 30min.) and then a taxi. We will organize shared taxis from Leobersdorf to Schloss Hernstein. If you are coming with your car and can take some people with you, please inform Birgit Schörkhuber.

Practical hints:

Single rooms are booked for the faculty members and invited speakers. Double rooms are booked for the PhD students. Meals are served buffet-style. Vegetarian options are available; gluten-free or lactose-free meals à la carte. Complementary WLAN (Wifi) is available in the lobby and the seminar room, internet terminals in the cafeteria.