Doctoral Day Mathematics — June 26, 2015

Time and Place: 10:30–13:00, Seminarraum 2 des Inst. f. Geometrie, Kopernikusgasse 24/IV, TU Graz.

10:30 — Hannah Vogel (KFU, advisor K. Baur):
Quivers of asymptotic triangulations

Abstract: Triangulations have associated quivers. We obtain asymptotic triangulations from finite triangulations by applying infinitely many Dehn twists or Coxeter transformations. The corresponding action on the associated quiver causes the quivers to become disconnected. Given a quiver, we are able to reconstruct the triangulation by looking at the subquivers, and do quiver mutation by considering quivers with potentials.

11:00 — Michael Kniely (KFU, advisor K. Fellner):
The Entropy Method for a Reaction-Diffusion-Poisson System

Abstract: The basic idea of an entropy approach is to bound an entropy functional from above by a multiple of its negative time-derivative, the so-called entropy dissipation. Such an estimate directly implies convergence to equilibrium and also gives an explicit bound for the convergence rate. In this talk, we will present a way for applying such an entropy approach to a system modeling reaction and diffusion of two electrically charged species. First, we discuss this reaction-diffusion-Poisson system as well as conservation laws and equilibrium states. We will then introduce an appropriate entropy functional and review the main ingredients of the entropy method. Using elementary and more involved inequalities, we are able to estimate parts of the entropy functional by its dissipation. Finally, we collect the remaining estimates, not proven so far, and discuss the main obstacles in the course of proving them.

11:30 — Break (coffee and refreshments)

12:00 — Eva Siegmann (KFU, advisor G. Haase):
Handling complex shaped particles in DEM simulations

Abstract: Numerical simulation of granular material is a huge challenge in terms of simulated process time, particle numbers and particle shape. The DEM (discrete element method) implemented in a suitable environment like CUDA is already able to simulate high number of particles. In industrial processes the shape of the particles plays an important role. This presentation focuses on this topic and shows how to handle different shaped particles like spheres, tablets and arbitrary shapes. For arbitrary shapes two different approaches will be presented. The first one mimics complex shapes by clustering several spheres into one particles and the second one uses polyhedrals.

12:30 — Daniel Ganellari (KFU, advisor G. Haase):
Fast many-core solvers for the eikonal equations in cardiovascular simulations.

Abstract: Simulation of heart beats which faithfully accounts for biophysical details is still far away from real time performance. We therefore propose a simpler model based on the eikonal equation, which could be very useful for for generating activation and repolarisation sequences by replacing the PDE part of the bi-domain equations with the eikonal equation, while retaining the ODE parts to account for the full mechanistic detail relevant to electrocardiagram computation. The approach can also be extended to mechanical contraction models.
In particular we are working on the following topics: implementing an eikonal solver with a low memory footprint for fast simulation, transferring the solver to handheld devices for clinical use, and parallel algorithms.