VORTRÄGE

Tenure Track Mathematics

Montag, 30. Mai 2016, Sky Lounge

- **9:00 Uhr: Lukas Parapatits (ETH Zürich)**

  "The Affine Surface Area in Convex Geometry"

Abstract: Valuations (finitely additive functionals on convex bodies) were introduced by Dehn to solve Hilbert's third problem at the beginning of the last century. Before Hadwiger started a systematic investigation of valuations in the 1950's, a first classification of affine-invariant valuations was obtained by Blaschke. However, it took until 1999 to find a classification that would also encompass Blaschke's affine surface area, which is a notion of surface area that is invariant under all volume preserving linear maps. Since this result of Ludwig and Reitzner, much more progress has been made. In my talk, I will first briefly review the history of this line of research in affine convex geometry and then present new classifications of scalar-, vector- and tensor-valued valuations in this setting. These results were established in a joint work with Christoph Haberl.

- **11:15 Uhr: Roland Donninger (Universität Bonn)**

  "Global aspects of nonlinear dispersive wave equations"

Abstract: I will review some of the exciting recent developments in the study of the global Cauchy problem for nonlinear dispersive wave equations. In particular, singularity formation and large-time behavior will be discussed. I will also outline the fruitful interaction of the field with other branches of mathematics and physics. Finally, I will mention some challenging open problems that are expected to guide research in the near and far future.

- **15:00 Uhr: Emanuele Spadaro (Max-Planck-Institut Leipzig)**

  „On the regularity of two-dimensional minimal surfaces"

Abstract: In this talk I will present some recent results on the regularity of two-dimensional generalized surfaces (more specifically, integral currents) which minimize or almost minimize the area functional. In particular, I will discuss a couple of interesting examples and I will describe the strategy of the proof. This is a joint work with C. De Lellis and L. Spolaor.

- **17:00 Uhr: Bogdan Matioc (Leibniz Universität Hannover)**

  "Fluid interfaces in porous media: the Muskat problem and its thin film approximation"

Abstract: We discuss analytic aspects of two related mathematical models describing two-phase fluid motions in porous media. The first model is the classical Muskat problem proposed initially to describe water encroachment into an oil sand and studied subsequently by many mathematicians with various analytic tools. We show that the Muskat problem is of parabolic type and use this property to obtain in a quite natural way local well-posedness and stability results.
For thin fluid layers, the full Muskat problem can be approximated by a strongly coupled parabolic system of equations having only the heights of the fluids as unknowns. This new model, called the Thin film Muskat problem, can also be viewed as the two-phase generalization of the classical Porous Medium Equation. We discuss the existence of weak solutions and qualitative aspects of the dynamics, such as large time asymptotics, finite speed of propagation, and waiting time phenomena.

Donnerstag, 2. Juni 2016, Besprechungszimmer 9. Stock

- **9:00 Uhr: Stefan Steinerberger (Yale University)**

  „Local analysis of elliptic PDEs"

Abstract: We describe a new approach to study elliptic PDEs: introduce time and look at the evolution of the parabolic equation for short time. Using basic estimates for parabolic PDEs, we can recover a lot of information about the fine structure of the solution of the original elliptic equation. We illustrate this trick by (1) giving a simple proof of the currently best result towards a conjecture of S. -T. Yau about Laplacian eigenfunctions and (2) simplifying/explaining recent heuristics for the Schrodinger equation and the landscape function arising in recent work of Arnold, David, Jerison, Filoche & Mayboroda.

- **11:15 Uhr: Elisa Davoli (Universität Wien):**

  „Homogenization problems in mechanics of materials"

Abstract: The mathematical theory of homogenization consists, roughly speaking, in determining the macroscopic behavior of heterogeneous structures when the size ε of the heterogeneity becomes "small".
In this talk I will focus on the problem of finding integral representations for limits of periodically oscillating integral energies, in the case in which the field under consideration are subject to periodically oscillating first order differential constraints.
The motivation for analyzing this class of problems comes from materials science, where the focus is often on structures which are made of two or more finely mixed materials. The fact that a composite often combines the properties of its constituents makes composite materials particularly interesting in many fields of science, and leads to the question of understanding some characteristics of the heterogeneous material (for example its thermal or electrical conductivity), starting from the knowledge of the corresponding properties of its constituents.
The talk will be based on Gamma-convergence, two-scale convergence, and A-quasiconvexity with variable coefficients, and will deal with some recent results obtained in collaboration with Irene Fonseca.
If time permits I will then move to the identification of lower dimensional models for thin structures, namely thin three-dimensional objects whose thickness in one direction is much smaller than the other dimensions (such as a membrane, a plate, or a shell), or whose cross-section is much smaller than the length (as a string or a rod). I will present a brief overview of my research activity in this direction and I will discuss a problem of simultaneous homogenization and dimension reduction for thin-plates exhibiting a multiscale periodic microstructure.