ZURICH GRADUATE COLLOQUIUM

Tuesday, 5:15 pm
Hermann Weyl Zimmer, ETH Zentrum
in alternation with the
Zurich Colloquium in Mathematics

Speaker: **Marc Oliver Rieger** (University of Zürich)

Title: **How can a computer see?**
How does a body break?
And why are these two questions connected?

Date: Tuesday, January 11th, 4:30 pm

We give an basic introduction into a problem that had been studied intensively in the last years in the field of calculus of variations. The so-called "Mumford-Shah functional" had been introduced in 1985 by Mumford and Shah for image decomposition, i.e. an algorithm for decomposing an image (which at first for a computer has no structure) into distinct pieces. This is of course the first step in image recognition, and is hence crucial to all applications based on visual identification of objects or persons by a computer.

Mathematically, the Mumford-Shah functional poses interesting questions regarding existence and regularity of its solutions. In this talk, however, we will study a different problem, namely its asymptotic limit when one of the parameters in the functional tends to zero (joint work with Paolo Tilli). For this purpose we use the method of "Gamma-convergence" which we will briefly introduce. This method has found numerous applications in the last years in various fields related to variational problems.

The limit problem of the Mumford-Shah functional which we obtain turns out to be very simple and its solutions can be computed very easily. Test images show the use and the limitation of this approach on image decomposition.

An interesting and surprising connection has previously been given between image decomposition and fracture mechanics: the Mumford-Shah functional appears also in models describing the propagation of a crack (Francfort-Marigo, Dal Maso-Toader). The limit problem that we obtained gives now interesting insights into these models. In particular, our result connects the approach by Francfort-Marigo and Dal Maso-Toader with a very different model for fracture mechanics using Young measure gradient flows (R. and R.-Zimmer.

If time permits, we will briefly explain this connection and illustrate its applications to fracture mechanics.

Speaker: **Michael Kupper**

Title: **Dynamic Monetary Risk Measures**

Date: Tuesday, January 11th, 5:45 pm

Probabilistic modelling of financial risks and different techniques to deal with them is a wide and active research area with interesting academic problems and many practical applications. A systematic treatment of "risk" started only seven years ago with the introduction of coherent and convex monetary risk measures and their relations with acceptance sets. If the random future evolution of discounted values is modeled in discrete time, a monetary risk measure can be viewed as a functional on the space of all bounded stochastic processes which are adapted to a given filtration. By the use of convex duality theory, representation results are given. Calculating the risk at different time points leads to the notion of a risk process. We give necessary and sufficient condition for so-called time-consistency and prove some representation results for such risk processes. Some examples and a construction method are discussed.

`http://www.math.ethz.ch/graduate/colloquium`

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