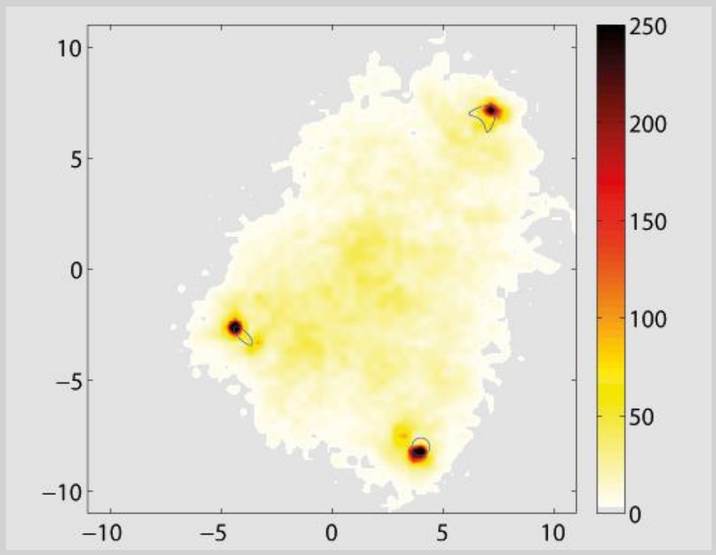

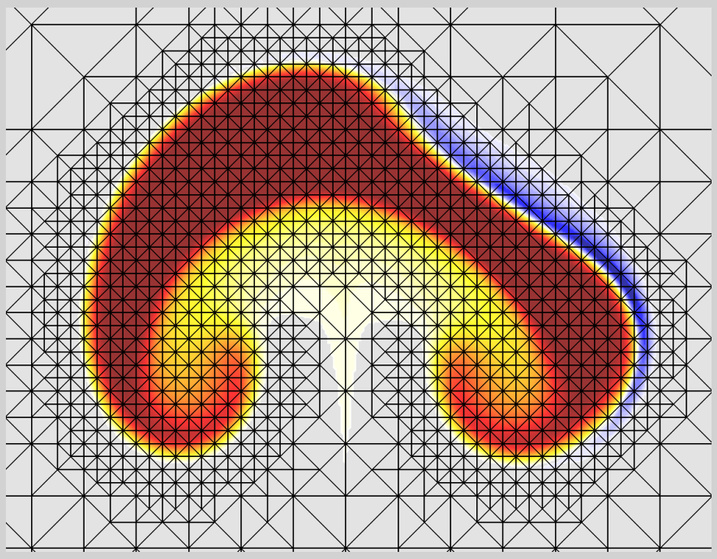

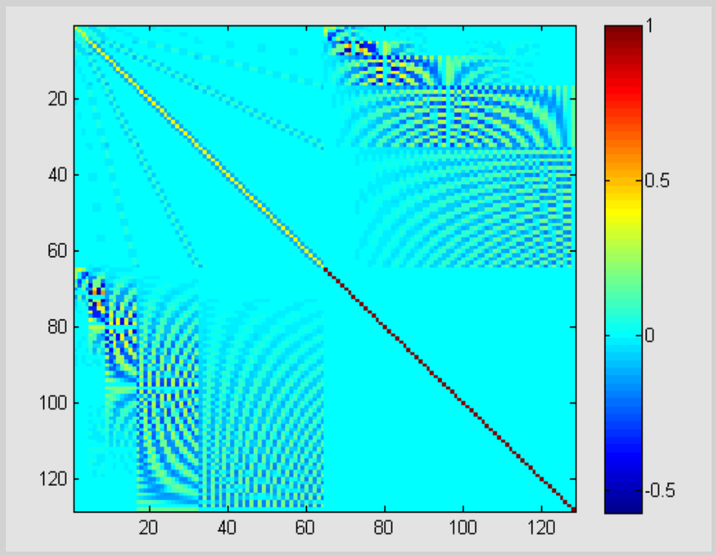

Oberseminar Numerik

Frau Prof. Dr. Jana Kopfova
(Opava University, Czech. Rep.)

18.11.14
14:15 Uhr
Hilbertraum (05-432)
Staudingerweg 9, 55128 Mainz

„Thermodynamic models for material fatigue under cyclic loading“

Abstract:

Elastoplastic materials subject to cyclic loading exhibit increasing fatigue, which is manifested by material softening, heat release and material failure in finite time.
The analysis of the so-called rainflow method for cyclic fatigue accumulation in uniaxial processes has discovered a qualitative and quantitative relationship between accumulated fatigue and dissipated energy. Indeed, the rainflow algorithm counts closed hysteresis loops in the loading history, and with each closed loop associates a number depending on its amplitude - the contribution of the loop to the total damage. This corresponds to the mechanism of energy dissipation: The number associated with a closed loop is its area in this case. In multiaxial loading processes, the concept of closed loop is meaningless, and no counterpart of the rainflow algorithm is known.
On the other hand, the notion of energy dissipation is independent of the experimental setting.We propose a model for fatigue accumulation based on the hypothesis that there exists a proportionality between fatigue and dissipated energy in the multiaxial case as well. We demonstrate our model on the examples of a transversally oscillating elastoplastic beams and plates. The full system consists of the momentum and energy balance equations, and an evolution equation for the fatigue rate. The main modeling hypothesis is that the fatigue rate is proportional to the dissipation rate. In nontrivial cases, the process develops singularity (material failure) in finite time. The main result consists in proving the existence and uniqueness of a strong solution.
I will discuss all the challenges this problems brings mathematically, present recent results and discuss some open problems.

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Hierzu sind alle herzlich eingeladen.

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