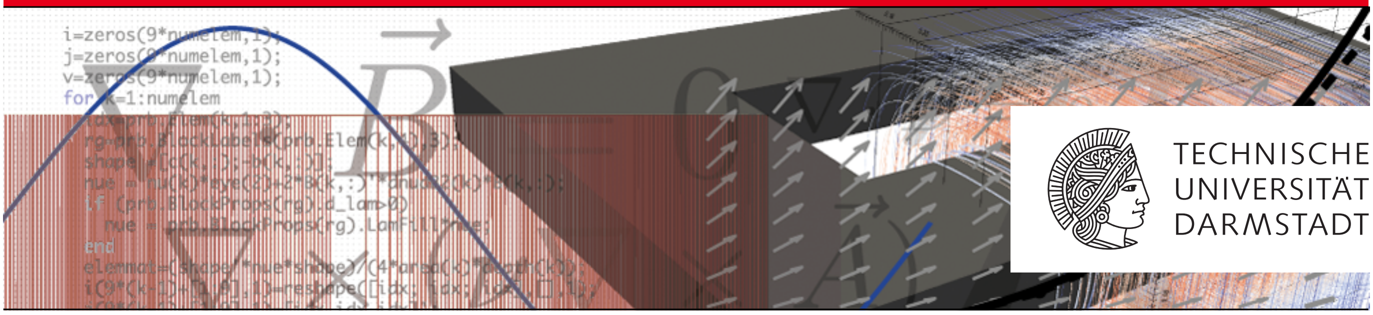
Stable and Fast Hysteresis Models for 3D Finite-Element Simulation

PhD position

Electrical Engineering / Material Science / Computational Engineering / Physics / Numerical Mathematics

Start: immediately



TECHNISCHE UNIVERSITÄT DARMSTADT

Description: Recently, remarkable improvements in material modelling have been achieved. Complicated nonlinear and hysteretic material behaviour can now be modelled with high precision. This opens perspective to better exploit existing materials or implement new, possibly problem tailored, materials. However, modern material models may be computationally too demanding to be embedded in large-scale 3D finite-element (FE) simulation. In this research project, the numerical impact of hysteresis models on the FE discretisation and the higher-order time integration schemes will be investigated. Model reductions for hysteretic materials will be developed. Ideas that will be implemented include (but are not restricted to) a computationally more efficient hysteresis model, a surrogate hysteresis model, a discrete empirical interpolation method, a multigrid technique or a static condensation technique. Further issues such as, e.g., identification of material parameters from measurement results and uncertainty quantification are addressed as well.

Requirements: Knowledge of electrodynamics and electromagnetic field simulation, interest in material science and material modelling, programming skills.

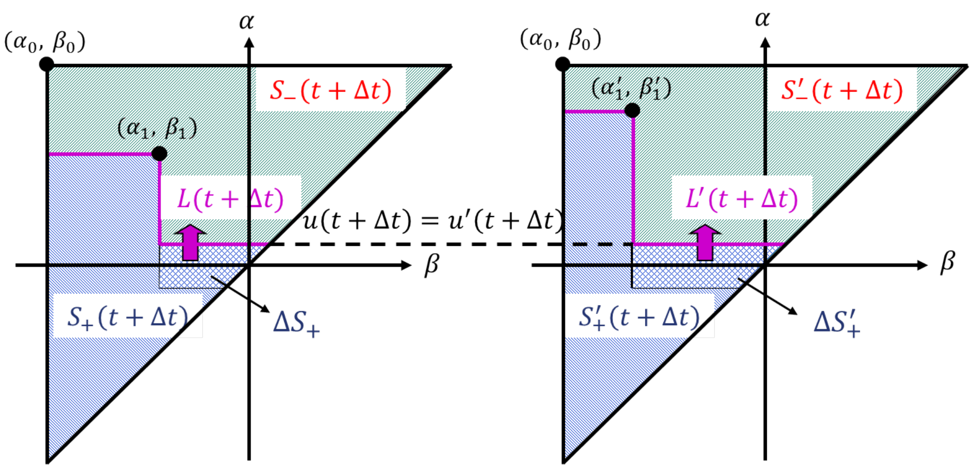


Figure 1: Preisach triangles illustrating the congruency property of the Preisach model.

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