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FAKULTÄT FÜR MATHEMATIK
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Einladung zur öffentlichen Defensio von

Marco Bresciani

Thema der Dissertation

Existence results and dimension reduction problems in large-strain magnetoelasticity

Abstract:

The thesis concerns the analysis of the variational model of Brown for magnetoelasticity at large-strains. A characteristic feature of this model consists in its mixed Eulerian-Lagrangian fomulation: while deformations are defined on the reference configuration (Lagrangian), magnetizations are defined on the deformed configuration in the actual space (Eulerian).

The thesis is subdivided into two parts. In the first part, we investigate the existence of solutions, both in the static and in the quasistatic setting. In the static setting, solutions correspond to minimiz-ers of the magnetoelastic energy while, in the quasistatic setting, these are understood in the energetic sense according to the theory of rate-independent processes. We establish a compactness result which, in particular, yields the convergence of the compositions of magnetizations with deformations. This en-ables us to prove the existence of minimizers by means of classical lower semicontinuity methods. Our compactness result also allows us to address the analysis in the quasistatic setting, where we examine rate-independent evolutions driven by applied loads and boundary conditions. In this case, we prove the existence of energetic solutions. At first, we restrict ourselves to the case of continuous deformations; subsequently, we assume that admissible deformations belong to the class of possibly discontinuous de-formations for which cavitation, i.e., the formation of voids inside the material, is excluded introduced by Barchiesi, Henao and Mora-Corral (2017).

In the second part of the thesis, we investigate the problem of dimension reduction for magnetoelastic plates. The aim is to identify a reduced two-dimensional model, as the thickness of the plate goes to zero, describing the asymptotic behaviour of minimizers of the magnetoleastic energy. We focus on low-energy configurations by rescaling the elastic energy according to the linearized von Kármán regime. First, we identify a reduced model by computing the Γ-limit of the magnetoleastic energy, as the thickness of the plate goes to zero. Then, we introduce applied loads given by mechanical forces and external magnetic fields, and we show that, under clamped boundary conditions, sequences of almost minimizers of the total energy converge to minimizers of the corresponding energy in the reduced model. Finally, we consider time-dependent applied loads and dissipation

functionals as in the first part of the thesis, and we prove that energetic solutions of the three-dimensional model converge, in the sense of dimension reduction, to energetic solutions of the reduced two-dimensional model. This last result provides a further justification of the latter in the framework of evolutionary Γ-convergence.

Prüfungssenat

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Zeit:

Topic: Marco Bresciani's defense
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