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Symposium Ferromagnetism

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SUMMARY

Session opening: G. Carbou
This symposium deals with numerical and theoretical aspects of ferromagnetic materials modeling.

Talk 1: David Sanchez (INSA Toulouse), *Stability of walls for narrowing ferromagnetic nano-wires.*

Following previous studies on ferromagnetic nano-wires, we are interested in narrowing nano-wires. We prove the existence of walls where the narrowing of the wire is effective for the magnetization switching and induces stability for the wall profile.

Talk 2: Stéphane Labbé (UJF Grenoble), *Modeling of heat effects in ferromagnetic materials.*

In this presentation, we will present a modeling of heat effects in ferromagnetic materials. The approach is based upon an upscaling from the microscopic scale to the mesoscopic scale. We present here the microscopic part through the description of the behavior of assemblies of magnetic momentums. We show the link between the microscopic scale and mesoscopic scale and describe the analysis of a the dynamic of a single pertubated momentum.

Talk 3: Radu Ignat (UPS Toulouse), *The cross-over from symmetric to asymmetric transition layers in a nonlocal and nonconvex variational model.*

We study the Landau-Lifshitz model for the energy of multi-scale transition layers in thin ferromagnetic films. Our main result is the rigorous derivation of a reduced model for the energy of the optimal transition layer, based on Gamma-convergence. The minimal energy splits into a contribution from an asymmetric, divergence-free core, and a contribution from two symmetric, logarithmically decaying tails. The contribution from the symmetric tails is computed explicitly, while the asymmetric core is analyzed via the harmonic map problem for S^2-vector fields satisfying a divergence constraint. As a consequence, we describe the bifurcation phenomenon from symmetric to asymmetric transition layers. This is a joint work with Lukas Doering and Felix Otto (Max-Planck Institute, Leipzig).

Talk 4: Hans Knuepfer (Institut fr Angewandte Mathematik), *Domain structure and hysteresis in bulk ferromagnetic magnets with external fields.*

We investigate the ground state of a uniaxial ferromagnetic plate with perpendicular easy axis and subject to an applied magnetic field normal to the plate. Our interest is the asymptotic behavior of the energy in macroscopically large samples near the saturation field. We establish the scaling of the critical value of the applied field strength below saturation at which the ground state changes from the uniform to a branched domain magnetization pattern and the leading order scaling behavior of the minimal energy. We also derive a reduced sharp-interface energy which gives the precise asymptotic behavior critical field under some a physically reasonable assumptions. This is joint work with Cyril Muratov.

Keywords: ferromagnetic materials, Landau-Lifschitz equations, multiscale effects