Thermodynamics of magneto- and poro-elastic materials at large strains

Prof. Dr. Tomas Roubíček (Charles University Prague, Czech Republic)

The theory of elastic magnets is formulated under possible diffusion and heat flow governed by Fick's and Fourier's laws in the deformed (Eulerian) configuration, respectively. The concepts of nonlocal nonsimple materials and viscous Cahn-Hilliard equations are used. The formulation of the problem uses Lagrangian (reference) configuration while the transport processes are pushed back. Except the static (or quasistatic) problems, the demagnetising field is ignored and only local non-selfpenetration is considered. The analysis as far as existence of weak solutions of the (thermo)dynamical problem is performed by a careful regularization and approximation by a Galerkin method, suggesting also a numerical strategy. Either ignoring or combining particular aspects, the model has numerous applications as ferro-to-paramagnetic transformation in elastic ferromagnets, diffusion of solvents in polymers possibly accompanied by magnetic effects (magnetic gels), or metal-hydride phase transformation in some intermetalics under diffusion of hydrogen accompanied possibly by magnetic effects (and in particular ferro-to-antiferromagnetic phase transformation), all in the full thermodynamical context under large strains. The talk is in large parts based on a joint paper with Giuseppe Tomassetti.