# Modeling and analysis of rate-independent processes

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## Abstract

Some physical processes like dry friction, elastoplasticity, damage, hysteresis in ferromagnets and shape-memory alloys can be modeled by rate-independent material laws. We provide mathematical models for such processes and discuss general existence results based on the energetic formulation which is based on the dissipation distance and the stored-energy funtional and thus constitutes a ”variational evolution” like gradient flows. Several applications are given and the question of convergence of solutions under Gamma convergence of the functionals is addressed. The latter theory provides convergence of numerical schemes and homogenization results.

## Schedule

1. Classical rate-independent models including elastoplasticity (evolutionary variational inequalities, sweeping processes, differential inclusions)

2. The energetic formulation via functionals (general theory on topological spaces, main existence result)

3. Viscous and kinetic regularizations (local versus local stability, rate-independent limits of viscous regularizations, quasistatic limits from systems with inertia)

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4. Applications in material models (damage, hysteresis in ferroelectricity, finite-strain elastoplasticity)
5. Relaxation and Gamma convergence for rate-independent processes (Gamma convergence, approximate incremental minimizers, weighted dissipation-energy functionals, homogenization)
6. Evolution of microstructures and numerical approaches