Nonlinear evolution equations of second order with damping: existence and discretization

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In this talk, we give an overview over some recent results concerning the analysis and numerical analysis of nonlinear evolution equations of second order in time. In particular, we focus on two classes of equations: evolution equations of second order in time with i) a nonlinear damping term that is monotone, coercive, and bounded together with a linear zero-order term that is symmetric, strongly positive, and bounded; ii) a linear damping term that is symmetric, strongly positive, and bounded together with a nonlinear, bo unded zero-order term that is the Gâteaux derivative of a possibly nonconvex, weakly coercive potential satisfying a generalization of the Andrews-Ball condition.

We study (weak) convergence of approximate solutions constructed from a simple semi- or full discretization, which then also implies existence of generalized solutions. Techniques from the theory of monotone operators and compactness arguments based on suitable a priori estimates and combined with stability properties of the numerical scheme are the basic ingredients. Examples arise, in particular, in solid mechanics and nonlinear elastodynamics.

This is joint work with Mechthild Thalhammer (Innsbruck) and David Šiška (Liverpool).