

In this thesis, we present an application of the hyperbolic minimizing movements method to dynamical problems in continuum mechanics. In the presented papers, we treat largely deforming viscoelastic solids with collisions, fluid-structure interactions with the slip condition, as well as a full time-discretization of this approach.

First, we obtain the existence result for nonlinear viscoelastic solids in the large deformation regime with arbitrary collisions. For this we construct a physically correct measure-valued contact force. This result is extended also for solids with only Lipschitz regular boundaries.

Next, we investigate a version of the hyperbolic minimizing movements scheme which is fully discrete in time. For this we show stability results and a linear convergence rate. This result is presented in the context of nonlinear elastodynamics.

Finally, we show the existence of weak solutions for nonlinear viscoelastic bulk solid coupled to a Navier-Stokes equation with a full slip condition at the fluid-solid interface. We provide the necessary classes of test functions for the weak solution, and we also show its consistency with the corresponding strong formulation.