Soft tissue simulation using discontinuous Galerkin FEM

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Modeling soft tissue deformations by means of incompressible elasticity theory has become a valuable tool for medical image analysis and surgical simulations. We solve a two-dimensional nonlinear dynamic elasticity problem for simulating soft tissue consisting of an incompressible material. Most often, such models are solved using continuous Galerkin finite element methods (CG-FEM). In this work, the spatial discretization is performed using a discontinuous Galerkin finite element method (DG-FEM) on a triangular grid. Time discretization is done by either an explicit or an implicit time integration scheme. To prevent possible numerical instabilities of DG-FEM a standard stabilization term is added penalizing the squared jump at the element faces. The method is evaluated for different model problems. We examine the convergence for different values of the stabilization term. In many cases, the DG-FEM exhibits higher accuracy and higher order of convergence in comparison to a conforming CG-FEM with the same number of elements.