Choosing starting vectors for Newton's method in nonlinear elasticity

Lina Fesefeldt[1] Sabine Le Borne[2]

In nonlinear elasticity, Newton's method is used to find a deformation that satisfies the equilibrium of external and internal forces. The convergence of Newton's method highly depends on the choice of the initial guess of the solution. In case of divergence, load steps can be used to stabilize the method: The force acting on the body is applied in increments, and each solution to the sub-problems serves as a new starting vector for the next load step. While this method is intuitive and established, it is also costly in computation time and memory. When the p-Version of FEM is used in combination with a hierarchical basis for the shape functions, a deformation always contains solutions for a lower maximum polynomial degree. We analyse the effect of using lower polynomial degrees on intermediate load steps on the convergence behaviour and overall computational costs.

[1]Hamburg University of Technology / Institute of Mathematics
lina.fesefeldt@tuhh.de

[2]Hamburg University of Technology / Institute of Mathematics
leborne@tuhh.de