JOHANNES KEPLER UNIVERSITY LINZ

Johannes Kepler University Linz
Institute of Numerical Mathematics
Univ.-Prof. Dr. Herbert Egger

NUMA INSTITUTE OF NUMERICAL MATHEMATICS

Talk announcement

Maria Heigl

(NuMa)

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Isogeometric Analysis for a non-linear elasticity problem

Isogeometric Analyisis (IgA) is a promising tool for the discretization of partial differential equations that allows the exact representation of objects from Computer Aided Design software, like circular shapes which cannot be represented exactly using standard Finite Element Methods (FEM). In this thesis, we consider a simplified model of a human artery based on non-linear elasticity equations. We first introduce the underlying physical model and define appropriate boundary conditions. For the model problem, we consider the St. Venant-Kirchhoff material law which is commonly used for modelling hyperelastic materials. The equilibrium state minimizes the total potential energy. Based on that, we define a minimization problem and the principle of virtual work is used for deriving a weak formulation. At this point, we discuss theoretic aspects regarding existence and uniqueness of a solution. For the discretization, the concept of IgA is introduced where we consider a computational domain consisting of multiple patches each parametrized with Non-Uniform Rational B-Splines (NURBS). In order to solve the discretized model problem numerically, we linearize the equations and use a Newton-Raphson iteration. Additionally, we consider an incremental loading method. Since we do not only consider the derived model problem in 3D, but also in 2D, we introduce appropriate model reduction schemes. Numerical experiments are provided, where we discuss the locking effect and solve the model problem representing an artery with different boundary conditions. Finally, we discuss the results, obtained in the IgA framework, and compare them with those computed by a FEM software.