

Utica Fall Workshop, July 17 - 28, 2023

Geometric Mechanics and Structure Preserving Discretizations of Shell Elasticity

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Interactive Talk, Dr. Michael Neunteufel

Netgen/NGSolve Developer TU Wien, Austria

Tu, July 25, 2pm, DON G172

Using Netgen/NGSolve to quickly translate models from solid mechanics, fluid dynamics and electromagnetic into efficient finite element code

The open-source finite element software NGSolve (www.ngsolve.org) is a flexible and high-performance library to solve PDEs numerically, including well-established and more advanced methods and finite elements. Due to its Python interface Lagrangian based discretization schemes as well as involved (hybrid-)discontinuous Galerkin (DG, HDG) and mixed methods can be set up and solved in a couple lines of Python code. The powerful NETGEN mesh generator being part of NGSolve project can mesh complicated (curved) geometries efficiently.

In this interactive talk we give an introduction to NGSolve with focus on (non-)linear elasticity including plates and shells. After a general overview of the Python interface we present how to set up and solve continuum mechanic problems. Additionally to well-established Lagrangian finite elements we discuss the application of mixed two- and three-field formulations including the tangential-displacement and normal-normal-stress continuous (TDNNS) method. We present how the Hellan-Herrmann-Johnson and TDNNS method can be used to obtain a locking-free discretization method for plates and shells.

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