The Hellan-Herrmann-Johnson method for nonlinear shells

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Finding appropriate discretizations for nonlinear shells is still a challenging problem. The Hellan-Herrmann-Johnson method introduces a moment tensor for computing fourth order Kirchhoff-plate equations as a mixed method [**1**].

In this talk we present a generalization of this method to nonlinear shells, where we may allow large strains. We assume the Kirchhoff-Love hypothesis to neglect shearing terms and focus on the bending energy, which is defined as the difference between the curvatures of the deformed and undeformed configuration of the shell. Therefore, we first show how the Weingarten tensor $S := \nabla_\tau \nu$ can be computed in a variational sense using H(divdiv)-conforming finite elements [**2**]. Then we introduce the moment tensor $\sigma \in$ H(divdiv) as the difference between these curvatures.

The method is implemented in NGS-Py, which is based on the finite element library Netgen/NGSolve (www.ngsolve.org). Finally, we present numerical results.

References.

[1] M. Comodi: The Hellan-Herrmann-Johnson method: some new error estimates and postprocessing, *Math. Comp. 52 (1989) pp. 17-29.*

[2] A. Pechstein and J. Schöberl: The TDNNS method for Reissner-Mindlin plates, *J. Numer. Math. (2017) 137, pp. 713-740.*