The Hellan-Herrmann-Johnson (HHJ) Method and the Tangential-Displacement Normal-Normal-Stress Continuous (TDNNS) Method

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The Hellan-Herrmann-Johnson (HHJ) method is a mixed finite element method to discretize Kirchhoff plate models. The tangential-displacement normal-normal-stress continuous (TDNNS) method is a method for the discretization of the elasticity equation. Both methods use matrix-valued normal-normal continuous finite element spaces for the momentum or stress variable, and also the bilinear-forms are tightly connnected. Based on the relation of these two methods, we propose new TDNNS spaces with less global degrees of freedom, and prove improved error estimates.

References:

[1] M. I. Comodi: The Hellan–Herrmann-Johnson Method: Some error estimates and postprocessing, Math. Comp. 52, 17–39, 1989

[2] A.S. Pechstein and J. Schöberl: An analysis of the TDNNS method using natural norms, 2016, https://arxiv.org/abs/1606.06853.

[3] D. Braess, A.S. Pechstein and J. Schöberl: An Equilibration Based A Posteriori Error Estimate for the Biharmonic Equation and Two Finite Element Methods, 2017, https://arxiv.org/abs/1705.07607

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