**Isogeometric Reissner-Mindlin shell analysis – Mixed formulation to avoid locking**

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The alleviation of locking effects is an important issue in the analysis of plate and shell problems using the Reissner-Mindlin approach, especially for thin structures. These effects lead to an artificial stiffening of the structure and an underestimation of the results. The use of higher order shape functions, as it is common in the Isogeometric Analysis, may reduce locking, however it automatically increases the computational cost. Other methods for the elimination of the locking phenomena in isogeometric plate and shell formulations have been adopted from the Finite Element Method. Some of these include the reduced integration, the $\bar{B}$ Method, the Assumed Natural Strain Method, the Discrete Shear Gap method, each of them having their advantages and disadvantages.

Here, the focus lies on the treatment of locking phenomena in an isogeometric Reissner-Mindlin shell formulation derived from continuum mechanics where the shell is described by its midsurface see [1]. Only linear problems are considered thus, a difference vector formulation is applied for the definition of the deformed director vector. The idea is to use a mixed method based on the Hellinger-Reissner two-field formulation with separate interpolation spaces for the deformations and the stresses [2]. The approximation spaces of the stress fields are chosen elementwise discontinuous in order to enable a static condensation at element level instead of patch level. The mixed method is tested for several numerical examples in order to confirm its accuracy and efficiency.

[1] W. Dornisch, R. Müller, S. Klinkel, An efficient and robust rotational formulation for isogeometric Reissner-Mindlin shell elements, Comput. Methods Appl. Mech. Engrg. 303 (2016) 1-34.
[2] R. Echter, B. Oesterle, M. Bischoff, A hierarchic family of isogeometric shell finite elements, Comput. Methods Appl. Mech. Engrg. 254 (2013) 170-180.