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Transverse shear parametrization in non-linear isogeometric shell analysis

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The isogeometric concept came along with an increasing activity in the scientific field of formulations and discretization methods for shell structures. In the early days, the advantage of higher continuity has been exploited for finite element formulations of the Kirchhoff-Love shell model. Later, also various isogeometric formulations of the Reissner-Mindlin shell model have been developed. They differ mainly in their parametrization of shear strains and the update of the shell director for non-linear analyses.

In [1], we presented a family of isogeometric shell finite elements that were based on a hierarchic concept. With linear shell kinematics this leads to an additive structure of the director update, which superimposes the shear part onto the updated Kirchhoff-Love type director. In [2], the additional assumption of only small shear rotations preserves this additive structure also for the formulation of large rotation elements.

In this contribution, we compare our hierarchic isogeometric shear deformable shell element to a fully non-linear shear deformable shell element, based on [3]. We discuss the role of transverse shear and effects of its parametrization in various analyses, e.g. including large deformation problems and non-linear material behavior ([4]).

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