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SIGNIFICANCE OF EXACT GEOMETRY IN STABILITY ANALYSES OF SHELLS

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Classical finite element analyses for shell structures are well established in commercial codes since a long time. The topic became a new dynamic with the development of the Isogeometric Analysis (IGA) [1], in which finite element methods use B-splines and NURBS as shape functions, for instance [2], [3], [4]. Smooth splines are particularly attractive in problems for which the weak form has a variational index of 2 or larger, for instance, the classical Kirchhoff-Love thin shell model. In addition, IGA can use "exact" geometry from CAD for computation.

The present study addresses linear buckling analyses of shells on the basis of a Kirchhoff-Love shell formulation; these are complemented by non-linear analyses of wrinkling membranes. It is demonstrated that isogeometric shell formulations may provide superior accuracy compared to standard shell finite elements in detecting both critical load levels and physical buckling or wrinkling patterns. In other words, the number of degrees of freedom is substantially lower for the same level of accuracy. The following question for the reason of the superior results is discussed: is the improved approximation of the solution by smooth splines compared to Lagrange/Hermite polynomials or the better, i.e. "exact", geometry within IGA the key factor? The parametric study investigates the influence of (exact) geometry, polynomial degree, smoothness and locking effects on the accuracy of results.

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