On some results for buckling and wrinkling analysis of thin shells and membranes with isogeometric methods

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ABSTRACT

In recent years, an increased activity in the scientific field of formulations and discretization methods for shell structures can be observed, see for instance [2], [3], [4], among many others. The topic has received a major boost due to the popularity of the isogeometric concept [1], along with finite element methods using NURBS or B-Splines as shape functions. Here, one of the decisive features is a relatively easy control of polynomial degree and continuity of shape functions, facilitating discretization of problems for which the weak form has a variational index of 2 or larger, for instance, the classical Kirchhoff-Love thin shell model. Another, most often mentioned feature of isogemetric analysis is the use of “exact” geometry from CAD for computation.

Own preliminary studies for buckling and wrinkling analyses of shells and membranes show, 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. That is, isogeometric shell formulations may require only a fractional amount of degrees of freedom for the same level of accuracy obtained with a fine finite element mesh. In this contribution, the reasons for this discrepancy are investigated in a systematic way, i. e., we study the influence of (exact) geometry, polynomial degree, smoothness/continuity and locking effects on the accuracy of results.

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