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AN ISOGEOMETRIC SOLID-SHELL FORMULATION OF THE KOITER METHOD FOR BUCKLING AND INITIAL POST-BUCKLING ANALYSIS OF COMPOSITE SHELLS

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Numerical formulations of the Koiter theory [1] allow the efficient prediction, through a reduced order model, of the behavior of shell structures when failure is dominated by buckling. In this work, we propose an isogeometric version of the method based on a solid-shell model. A NURBS-based interpolation [2] is employed on the middle surface of the shell to accurately describe the geometry and the high continuity typical of the displacement field in buckling problems and to directly link the CAD model to the structural one. A linear interpolation is then adopted through the thickness together with a modified generalized constitutive matrix, which allows us to easily eliminate thickness locking and model multi-layered composites. Reduced integration schemes, which take into account the continuity of the shape functions, are used to avoid interpolation locking and make the integration faster. A Mixed Integration Point strategy [3] makes it possible to transform the displacement model into a mixed (stress-displacement) one, required by the Koiter method to obtain accurate predictions, without introducing stress interpolation functions. The result is an efficient numerical tool for buckling and initial post-buckling analysis of composite shells, characterized by a low number of DOFs and integration points and by a simple and quick construction of the reduced order model.

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