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INTERLAMINAR STRESS MODELING OF COMPOSITE KIRCHHOFF PLATES COMBINING IMMERSED ISOGEOMETRIC ANALYSIS AND EQUILIBRIUM

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The interest for composites has constantly grown in recent years especially in the aerospace and automotive industries as they can be moulded in complex form and geometry and exhibit enhanced engineering properties. Nevertheless, despite the accelerated diffusion of laminated composites, the design of those materials is often restrained by the lack of cost-efficient modeling techniques. More importantly, the existing strategies allowing for cheap simulations (see, e.g., [1]) usually fail to directly capture interlaminar stresses, which prove to be typically responsible of failure modes such as delamination.

To treat complex structures as well as trimmed surfaces, immersed approaches have been proved to be a viable alternative to mesh-conformed discretizations [2]. Therefore, we propose to extend the stress recovery approach introduced in [3] combining the Finite Cell Method (FCM), Isogeometric Analysis (IgA), and equilibrium to model the out-of-plane behavior of Kirchhoff laminated plates.

In this study, we consider a displacement-based classical laminate plate theory (CLPT) approach, which provides the lowest computational cost among known literature strategies, within an FCM-IgA framework that allows us to break away from the complexity of the geometry and possible complications in the meshing procedure. Since the recovery-based approach in [3] involves high-order in-plane derivatives, IgA represents a natural simulation framework given its high continuity properties and excellent accuracy-to-efficiency ratio. Extensive numerical tests showcase the effectiveness of the proposed approach.

REFERENCES

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