Adaptive refinements in isogeometric simulations of thermo-mechanical problems using hierarchical splines

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ABSTRACT

It has been known that isogeometric analysis (IGA) [1] provides accurate solutions at relatively low cost on domains with complex geometry, provided that the approximated solution is smooth. In the case of non-smooth solutions, standard IGA based on tensor product basis functions is less efficient due to a lack of local refinement property.

Several methods have been proposed to enable localized refinements in the context of IGA. In this work, the application of adaptive higher-order methods based on polynomial splines over hierarchical T-meshes [2] to coupled thermo-mechanical problems is investigated. To drive the adaptive refinement, an efficient recovery-based error estimator based on the superconvergence theory is constructed. The estimator produces a ``recovered solution'' which is a more accurate approximation than the computed numerical solution.

Several 2D and 3D numerical investigations with hierarchical splines of higher order and greater continuity show that the proposed method provides more accurate solutions compared to uniformly-refined splines. Applications to additive manufacturing processes and to design optimization are also being investigated.

REFERENCES

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