An adaptive collocated method for PHT splines with optimal selection of collocation points

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ABSTRACT

We propose an adaptive isogeometric analysis (IGA) collocation method with a recovery-based error estimator. The proposed collocation method is based on a new basis for polynomial hierarchical splines over T-meshes (PHT-splines) [1]. The improved method collocates at Gauss points [2] in the interior of the domain, which are the optimal for the new PHT elements with C1 continuity. Near the boundary, the locations of the collocation points are determined by an optimization method based on machine learning algorithms.

The new PHT basis is based on local knot vectors and has improved conditioning compared to the original PHT basis [3]. Furthermore, based on the new PHT basis, the improved IGA collocation can be extended to arbitrary degree polynomials. The local refinement strategy is driven by a recovery-based error estimator by computing a higher order recovered solution. The improved IGA collocation method is also compared with the Galerkin method as well as the Greville-abscissae collocation. The improved IGA collocation has been tested on several 2D and 3D problems and results in optimal convergent rates and high accuracy and robustness of the approximation.

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