Local THB-Multigrid

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May 7, 2019

Abstract

We present a h-robust multigrid solver for Isogeometric Analysis (IgA) schemes based on Truncated Hierarchical Basis (THB) splines, which only uses local relaxations.

Mesh refinement in IgA is more involved than in the finite element method. In particular, we use THB-splines for localized meshes in our adaptive IgA scheme. So far, the solution of the emergent large scale, uniformly sparse linear systems has indeed been addressed (Hofreither et al., 2017), but an authoritative theoretical analysis of these tailored iterative solvers has been elusive.

We adapt the multigrid method of (Hofreither et al., 2017) inasmuch relaxations are performed on a smaller number of degrees of freedom, which are related to the local features of the adaptive scheme. We deduce a rigorous convergence analysis of this Local Multigrid Method based on the celebrated Xu-Zikatanov formula and a new THB-quasi interpolant as proposed in (Buffa and Giannelli, 2015) and (Speleers and Manni, 2018). The topic of computational complexity will be addressed.

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