ADAPTIVE SPACE-TIME ISOGEOMETRIC ANALYSIS

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ABSTRACT

This talk is concerned with locally stabilised space-time IgA approximations to initial boundary value problems of the parabolic type. Originally, similar, but globally stabilised space-time IgA schemes were presented and studied by Langer, Neumüller, and Moore (2016) [1]. The current work devises a localised version of this scheme that is more suited for adaptivity. We prove coercivity (ellipticity), boundedness, and consistency of the mesh-dependent bilinear form generating the IgA scheme. Using these fundamental properties together with the corresponding approximation error estimates for B-splines, we show that space-time IgA solutions generated by the new scheme satisfy asymptotically optimal a priori discretization error estimates. For adaptive mesh refinement algorithm, we choose the functional a posteriori error control approach that has been rigorously studied in earlier works by Repin (2002) [2] and Langer, Matculevich, and Repin (2017) [3]. We present numerical results that confirm improved global error convergence as well as the local efficiency of the error indicators that follow from the error majorants.

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REFERENCES

[1] Langer, U., Moore, S., and Neumüller, M.: Space-time isogeometric analysis of parabolic evolution equations. *Comput. Methods Appl. Mech. Engrg.*, **306**, 342–363 (2016)

[2] Repin, S. I.: Estimates of deviations from exact solutions of initial-boundary value problem for the heat equation. *Rend. Mat. Acc. Lincei*, **13**(9), 121–133 (2002)

[3] Langer, U., Matculevich, S., and Repin, S.: Guaranteed error control bounds for the stabilised space-time IgA approximations to parabolic problems, *arXiv.org*, arXiv:math.CS/1712.06017v2 (2017)

[4] U. Langer, S. Matcuelvich, and S. Repin. Adaptive space-time isogeometric analysis of parabolic evolution problems. *arXiv.org*, math.NA/1807.05950, 2018.