SUPER-LOCALIZED ORTHOGONAL DECOMPOSITION FOR HIGH-FREQUENCY HELMHOLTZ PROBLEMS

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ABSTRACT

In this talk, we present a new variant of the Localized Orthogonal Decomposition (LOD) method for time-harmonic wave propagation modeled by the Helmholtz equation. Following [1], the method identifies local finite element source terms that yield rapidly decaying responses under the solution operator. Those can be constructed on patches of width ℓH, and are used as problem-adapted basis functions in the method. In contrast to the classical LOD as presented in [2] and other state-of-the-art multiscale methods, the localization error decays super-exponentially as the oversampling parameter ℓ is increased.

We present an abstract error analysis as well as numerical experiments that demonstrate the super-exponential decay of the localization errors and an optimal order of convergence.

References

[1] M. Hauck and D. Peterseim. Super-localization of elliptic multiscale problems. ArXiv e-prints, 2021.

[2] D. Peterseim. Eliminating the pollution effect in Helmholtz problems by local subscale correction. Math. Comp., 86(305):1005-1036, 2017.

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