

# **Auxiliary space multigrid method for high-frequency high-contrast problem**

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**Abstract.** We introduce a multigrid algorithm for elliptic boundary-value problems that is based on simultaneous two-level factorization of local (finite element stiffness) matrices associated with a sequence of coverings of the entire domain by overlapping or non-overlapping subdomains. In this method, “coarse-grid correction” is defined in an auxiliary space which is equipped with an energy inner product. The construction is such that not only the (globally) energy minimizing interpolation (in the auxiliary space) but also the related Galerkin coarse-grid operator have a sparse matrix representation. We present a two-grid analysis and discuss favorable properties of this method, including robustness for high-frequency high-contrast problems and aspects of parallelization.