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Two-level Schwarz methods with coarse spaces based on Dirichlet–to–Neumann maps

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Coarse grid correction is a key ingredient in order to have scalable domain decomposition methods. For smooth problems, the theory and practice of such two-level methods is well established. We consider problems with high contrasts in the coefficients. We construct the coarse space using the low frequency modes of the subdomain DtN maps. A theoretical estimate of the condition number of the additive Schwarz method (ASM) enables us to select the necessary eigenvectors to be added to the coarse space in order to have a convergence rate of the order of the constant coefficient case. Our method is suitable for the parallel implementation. Its efficiency is demonstrated by numerical examples on problems with high heterogeneities for both manual and automatic partitionings.

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