

Original Articles

Multiscale Domain Decomposition Methods for Elliptic Problems with High Aspect Ratios

Jorg Aarnes (1), Thomas Y. Hou (2)

(1) Department of Mathematics, University of Bergen, Johs. Brunsgt;(2)Applied Mathematics, 217-50, Caltech

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摘要 In this paper we study some nonoverlapping domain decomposition methods for solving a class of elliptic problems arising from composite materials and flows in porous media which contain many spatial scales. Our preconditioner differs from traditional domain decomposition preconditioners by using a coarse solver which is adaptive to small scale heterogeneous features. While the convergence rate of traditional domain decomposition algorithms using coarse solvers based on linear or polynomial interpolations may deteriorate in the presence of rapid small scale oscillations or high aspect ratios, our preconditioner is applicable to multiple-scale problems without restrictive assumptions and seems to have a convergence rate nearly independent of the aspect ratio within the substructures. A rigorous convergence analysis based on the Schwarz framework is carried out, and we demonstrate the efficiency and robustness of the proposed preconditioner through numerical experiments which include problems with multiple-scale coefficients, as well problems with continuous scales.

关键词 [multiscale elliptic problems](#) [domain decomposition](#)

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通讯作者 Jorg Aarnes jaarnes@mi.uib.no

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