A Hybrid Domain Decomposition and Shifted Laplacian Multigrid Preconditioner for the Elastic Helmholtz Equation

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Shifted Laplacian multigrid is a well known approach for preconditioning the indefinite linear system arising from discretizing the acoustic Helmholtz equation. This equation is used to model wave propagation in the frequency domain. However, in some cases the acoustic equation is not sufficient for modeling the physics of the wave propagation, and one has to consider the elastic Helmholtz equation. Such a case arises in seismic imaging applications, where the earth subsurface is the elastic medium. In this talk we extend the shifted Laplacian approach to the elastic Helmholtz equation, by combining the complex shift idea with multigrid approaches for linear elasticity. Because the resulting linear system is extremely large, we also integrate this multigrid preconditioner in a distributed domain decomposition preconditioner. We show numerical experiments for problems with heterogeneous media.

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