Optimized double sweeping Schwarz method with complete radiation boundary conditions for the Helmholtz equation

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ABSTRACT

In this paper, we study an optimized double sweeping Schwarz method in the nonoverlapping domain decomposition framework. Since the sweeping Schwarz method was proposed in [1], many effective sweeping domain decomposition techniques have been developed to solve wave propagation problems, in particular, the advent of accurate radiation conditions such as PML has enriched this research as found in [2–4]. In this study, we exploit the complete radiation boundary conditions (CRBC) for approximating radiation conditions supplemented with Neumann data as incoming data to neighboring subdomains in the sweeping process. Here the CRBC is designed for a high-order absorbing boundary condition in [5] and also utilized for accurate transmission conditions for the Jacobi-type nonoverlapping Schwarz method in [6]. It is noted that CRBCs can be optimized by choosing optimal damping parameters, which results in fast convergence of the Schwarz algorithm. We will prove the convergence of the method and present numerical examples illustrating that this method can be used as an efficient preconditioner for GMRES iterations.

REFERENCES