ITERATIVE METHODS FOR HELMHOLTZ PROBLEMS

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Abstract

In contrast to the positive definite Helmholtz equation, the deceivingly similar looking indefinite Helmholtz equation is difficult to solve using classical iterative methods. Applying directly a Krylov method to the discretized equations without preconditioning leads in general to stagnation and very large iteration counts. Using classical incomplete LU preconditioners can even make the situation worse. Classical domain decomposition and multigrid methods also fail to converge when applied to such systems.

The purpose of this presentation is to investigate in each case where the problems lie, and to explain why classical iterative methods have such difficulties to solve indefinite Helmholtz problems. I will also present remedies that have been proposed over the last decade, for incomplete LU type preconditioners, domain decomposition and also multigrid methods.