Optimal preconditioners for nonsymmetric multilevel Toeplitz systems with application to solving non-local evolutionary PDEs

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Abstract

Preconditioning for multilevel Toeplitz systems has long been a focal point of research in numerical linear algebra. In this talk, we present a new preconditioning method for nonsymmetric multilevel Toeplitz systems, including those from evolutionary PDEs. These systems have recently garnered considerable attention in the literature. For these equations, we propose a symmetric positive definite multilevel Tau preconditioner that is efficient and optimal, ensuring mesh-independent convergence with the preconditioned generalized minimal residual method. Numerical examples highlight our method's effectiveness, particularly for non-local, time-dependent PDEs solved in parallel.