Block-smoothers in multigrid methods for circulant and Toeplitz matrices

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Circulant matrices and Toeplitz matrices arise in a variety of applications including signal processing and partial differential equations. For banded multi-level matrices multigrid methods have been developed, e.g., in [1] for Toeplitz matrices and in [2] for multilevel circulant matrices. Most of the analysis focuses on Richardson iterations as smoother. This is sufficient from a theoretical viewpoint, nevertheless a different choice of the smoother can significantly speed up the resulting methods.

Possible choices for smoothers include multicolor-SOR or block smoothers, where instead of relaxing single unknowns small blocks are inverted. Both types of methods can be described using the framework presented in the talk. For the theoretical analysis proper decompositions of the system matrices are used that allow for a detailed analysis of the resulting method. The analysis tools fit in the established framework that is used to analyze multigrid methods for Toeplitz and circulant matrices.

References
