Multilevel iterative aggregation-disaggregation methods for Markov chains

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Abstract

We consider numerical solution of stationary probability distribution vectors of discrete time Markov chains. More precisely, we search for $x > 0$ with $Bx = x$, where B is a large and sparse irreducible column stochastic matrix.

Iterative aggregation-disaggregation (IAD) methods have became a competitive tool compared to other methods of numerical linear algebra [1], [5], though their theoretical background is not sufficiently developed yet. We bring several new results on convergence of these methods [2], [3], [4]: i) a formula for the error propagation matrix for a certain class of multilevel IAD methods; ii) examples that spectral radii of the asymptotic error propagation matrices can be arbitrarily large; iii) a proof of convergence of a certain class of two-level IAD methods for $B = DSD^{-1}$ where D is nonnegative and diagonal and S is symmetric.

Keywords

Markov chains, Iterative aggregation-disaggregation methods, Multilevel algorithms.

References

[1] De Sterck, H., T.A. Manteuffel, S.F. McCormick, K. Miller, J. Pearson, J. Ruge, and G. Sanders (2010). Smoothed aggregation multigrid for Markov chains. *SIAM J. Sci. Comput. 32*, 40–61.

[2] Pultarová, I. (2008). Necessary and sufficient local convergence condition of one class of iterative aggregation – disaggregation methods. *Numer. Linear Algebra Appl. 15*, 339–354.

[3] Pultarová, I. and I. Marek. Convergence of multi-level iterative aggregation-disaggregation methods. Submitted.

[4] Pultarová, I. and I. Marek. Physiology and pathology of iterative aggregation-disaggregation methods. Submitted.

[5] Stewart, W.J. (1994). *Introduction to the Numerical Solutions of Markov Chains*. Princeton University Press.