Reusing information in iterative methods

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Abstract

Recycling-type iterative methods are a class of methods which efficiently allow for reuse of information for solving sequences of systems of linear equations. Such sequences arise in many different application areas, e.g., time-evolving fluid-flow problems, shape optimization, astrophysical simulations, medical imaging, etc. Such problems are often treated by Krylov subspace methods. The idea is that if each subsequent problem (i.e., the coefficient matrix) is in some way "close" to its predecessor, we may be able to reuse information obtained during the solution of one problem to accelerate the solution of subsequent problems.

Recycling is emerging as a promising technique also for multilevel and domain decomposition methods. These methods require the solution of a certain subproblem in each iteration – either the problem on the coarsest level or the problems corresponding to the subdomains. With rapid growth of the size of the problems that are being solved, the size of the subproblems is also growing. These subproblems are often solved iteratively, for example, via a Krylov subspace method. As the coefficient matrix corresponding to the subproblems remains static between iterations, recycling may be used to speed up the computation and in some cases also to lower the memory requirements.

This minisymposium is focused on new advances in techniques which reuse information obtained during the solution of a single subproblem to accelerate the solution of subsequent subproblems, in particular within multilevel and domain decomposition methods. Many talks concern methods of subspace recycling and related techniques, but other talks (which have the same philosophical but different mathematical approaches) are also included in order to foster conversation and to broaden our understanding of how one can use existing information to drive the convergence of iterative methods.

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