Journal of Applied Mathematics

Special Issue on Preconditioning Techniques for Sparse Linear Systems

Call for Papers

The accurate and efficient solution to sparse linear systems of equations, arising from the discretization of PDEs, often represents the main memory- and time-consuming tasks in a computer simulation. Direct methods are still widely used on the basis of their robustness and reliability. However, they generally scale poorly with the matrix size, especially on 3D problems. For large sparse systems, iterative methods based on Krylov subspaces are a most attractive option. Several Krylov subspace solvers have been developed during the 1970s through the 1990s, and they are generating a growing interest in many areas of engineering and scientific computing. Nonetheless, to become really competitive with direct solvers they need an appropriate preconditioning to achieve convergence in a reasonable number of iterations.

It is widely recognized that preconditioning is the key factor to increase the robustness and the computational efficiency of iterative methods. Unfortunately, theoretical results are few, and it is not rare that "empirical" algorithms work surprisingly well despite the lack of a rigorous foundation. The research on preconditioning has significantly grown over the last two decades and currently appears to be a much more active area than either direct or iterative solution methods. On one hand, this is due to the understanding that there are virtually no limits to the available options for obtaining a good preconditioner. On the other hand, it is also generally recognized that an optimal general-purpose preconditioner is unlikely to exist, so new research fields can be opened for improving the computational efficiency in the solution of any specific problem at hand on any specific computing environment.

We invite investigators to contribute original research articles as well as review articles on the development and the application of preconditioning techniques for the solution to sparse linear systems. Potential topics include, but are not limited to:

- Development and numerical testing of novel preconditioners
- Development and numerical testing of preconditioners for specific applications
- Improvement of existing general-purpose algebraic preconditioners
- Theoretical advances on the properties of existing general-purpose algebraic preconditioners
- Application of existing techniques to novel fields

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Manuscript Due	November 1, 2011
First Round of Reviews	February 1, 2012
Publication Date	May 1, 2012

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