# Special Volume on Large Scale Eigenvalue Problems

Many scientific and engineering problems require the computation of a small subset of the eigenvalues of extremely large matrices. For example, structural engineering problems require these eigenvalues for stability analysis, quantum chemistry models use these eigenvalue/eigenvector pairs in minimum energy eigenfunction calculations, and fluid flow problems use these eigenvalues to detect the onset of turbulence. Common features of these eigenvalue problems are (1) the number of eigenvalues required is small relative to the size of the matrices and (2) the matrix systems are often very sparse or structured. A standard technique is to formulate a spectral transformation such as shift-invert in order to enhance the convergence to the eigenvalues and eigenvectors of interest. Though convergence can often be dramatically improved via a spectral transformation, linear systems must now be solved. Directly factoring the matrix is often impractical because of the excessive memory and computational requirements.

On May 14–16, 1997, Paul Plassmann and Richard B. Lehoucq hosted a workshop at Argonne National Laboratory called "The Use of Iterative Methods for Large Scale Eigenvalue Problems." The workshop generated interest within the numerical linear algebra community and was attended by a number of its leading researchers. The papers in this special issue were presented at that workshop.

An important theme of the workshop was eigenvalue/eigenvector computation methods which use iterative linear solvers instead of direct matrix factorizations. Seven of the thirteen papers in this special issue focused on that workshop topic. These papers provide an excellent synopsis of the current and emerging research on the many aspects required to make this approach robust and efficient, especially for non-Hermitian eigenvalue problems. The remaining papers cover a range of important topics related to the computation of large scale eigenvalue problems.

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