TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

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An Algebraic Multigrid Preconditioner for a class of singular M-Matrices

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We consider the problem of the computation of stationary distributions of Markov chains which arises in many different application areas. These range from the distribution of drugs in the blood circulation systems to the Page Rank computed by Google. The task is to compute the left eigenvector corresponding to the largest eigenvalue of the transition matrix T or alternatively solve the linear system

$$(I - T^T)x = 0,$$

where the matrix $(I - T^T)$ is a singular M-matrix. In applications, these matrices are large and sparse. Therefore, iterative methods such as GMRES are applied. However, the applicability of GMRES depends on whether it is possible to find a suitable preconditioner. For symmetric positive definite M-matrices obtained from discretizations of boundary value problems the algebraic multigrid is well known to be a good preconditioner. We give an introduction to the algebraic multigrid method and show how it is possible to apply it to our special case of singular non-symmetric M-matrices. We will show numerical examples that illustrate that this leads to significant acceleration of the convergence speed.