

TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Wednesday, 10 April 2019, 4:00 p.m.
Room 617 Wachman Hall
(refreshments and social at 3:45 p.m)

Classical iterative methods for the solution of Generalized Lyapunov Equations

by Daniel B. Szyld
Temple University

Abstract. There has been a flurry of activity in recent years in the area of solution of matrix equations. In particular, a good understanding has been reached on how to approach the solution of large scale Lyapunov equations. An effective way to solve Lyapunov equations of the form $A^T X + X A + C^T C = 0$, where A and X are $n \times n$, is to use Galerkin projection with appropriate extended or rational Krylov subspaces. These methods work in part because the solution is known to be symmetric positive definite with rapidly decreasing singular values, and therefore it can be approximated by a low rank matrix $X_k = Z_k Z_k^T$. Thus the computations are performed usually with storage which is lower rank, i.e., much lower than order of n^2 .

Generalized Lyapunov equations have additional terms. In this talk, we concentrate on equations of the following form

$$A^T X + X A + \sum_{j=1}^m N_j X N_j^T + C^T C = 0,$$

Such equations arise for example in stochastic control.

This is joint work with Stephen D. Shank and Valeria Simoncini.