Elhashash, Abed

On General Matrices Having the Perron-Frobenius Property

By *Abed Elhashash and Daniel Szyld.*

We say that a matrix has the Perron-Frobenius property if its spectral radius is an eigenvalue for which there is an entry-wise nonnegative eigenvector. Matrices having the Perron-Frobenius property may be viewed as generalizations of nonnegative matrices. We consider spaces consisting of such generalized nonnegative matrices and study some of their topological aspects such as connectedness and closure. In addition, we completely describe the similarity transformations leaving such spaces invariant. We prove some new results needed for the analysis mentioned above, in which we show the existence of orthogonal matrices close to the identity which map semipositive vectors to positive ones. This new tool may be useful in other contexts as well.

Keywords: Eventually Nonnegative Matrices, Generalizations of Nonnegative Matrices, Perron-Frobenius Property

AMS classification: 15A48

Noutsos, Dimitrios

Reachability cone of eventually exponentially nonnegative matrices

By *Dimitrios Noutsos and Michael Tsatsomeros.*

We examine the relation between eventual exponential nonnegativity of a matrix A ($e^{tA} \geq 0$ for all sufficiently large $t \geq 0$) and eventual nonnegativity of $I + hA$, $h \geq 0$ ($(I + hA)^k \geq 0$ for all sufficiently large $k \geq 0$). As a consequence, we are able to characterize initial points $x_0 \in \mathbb{R}^n$ such that $e^{tA}x_0$ becomes and remains nonnegative as exactly those points for which the discrete trajectories $x^{(k)} = (I+hA)^k x_0$ become and remain nonnegative. This extents work on the reachability cone of exponentially nonnegative matrices by Neumann, Stern and Tsatsomeros [1]. [1] M. Neumann, R.J. Stern, and

M. Tsatsomeros. The reachability cones of essentially nonnegative matrices. *Linear and Multilinear Algebra*, 28:213–224, 1991.

Keywords: Eventually nonnegative matrix; eventually exponentially nonnegative matrix; point of nonnegative potential; reachability cone

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Szyld, Daniel

Convergence of Stationary Iterative Methods for Hermitian Semidefinite Linear Systems

By *Andreas Frommer, Reinhard Nabben, and Daniel B. Szyld.*

A simple proof is presented of a quite general theorem on the convergence of stationary iterations for solving singular linear systems whose coefficient matrix is Hermitian and positive semidefinite. In this manner, elegant proofs are obtained of some known convergence results, including the necessity of the P-regular splitting result due to Keller, as well as recent results involving generalized inverses. Other generalizations are also presented. These results are then used to analyze the convergence of several versions of algebraic additive and multiplicative Schwarz methods for Hermitian positive semidefinite systems.

Keywords: Hermitian semidefinite systems, singular systems, stationary iterations, convergence analysis

AMS classification: 65F10