

Reachability cone of eventually exponentially nonnegative matrices

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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 extends 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.