On Matrix-Polynomials with Nonnegative Coefficients

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We discuss properties of eigenvalues, eigenvectors and generalized eigenvectors of a matrix-polynomial L of following type

$$L(z) = zId - (z^2 A_2 + zA_1 + A_0), \quad z \in \mathbb{C},$$

where the coefficients A_j are entrywise nonnegative matrices. Subsequently we will examine some applications of these results to graph theory, multistep methods and Markov chains.