MATRIX POLYNOMIAL PROBLEM

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Let $A(x) = \sum_{i=0}^{n} A_i x^i$ be a square matrix where A_is are $m \times m$ matrices with complex entries and assume that $A(x)$ is regular, i.e., $detA(x)$ is not identically zero. The roots of $detA(x)$ coincide with the eigenvalues of the matrix polynomial $A(x)$, which are classically defined as the complex values λ for which there exists a nonzero vector v such that $A(\lambda)v = 0$. Computing the eigenvalues of a matrix polynomial is known as a polynomial eigenvalue problem.

We extend the classical bounds of Hadamard, Ostrowski and Pólya for locating the roots of a polynomial to the case of a matrix polynomial to locate its eigenvalues. These theoretical results can be used to determine effective initial approximations for the numerical computation of the eigenvalues of matrix polynomials by means of simultaneous iterations, like the Ehrlich-Aberth method. We also develop a scaling technique for the numerical computation of the eigenvalues of $A(x)$.