Towards a robust polynomial eigenvalue solver

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In this talk we discuss an algorithm for solving unstructured polynomial eigenvalue problems that is based on linearization but additionally incorporates a preprocessing and a postprocessing phase to reduce backward and forward error bounds of the computed eigenvalues.

In the preprocessing phase the coefficient matrices and the eigenvalue parameter are rescaled to potentially reduce condition numbers of the eigenvalues and the factors in the backward error bounds. Then a scaled companion linearization is used to solve the polynomial eigenvalue problem.

In a postprocessing phase an iterative refinement procedure is applied if computed eigenpairs have a large backward error. For each eigenpair this refinement needs only $\mathcal{O}(n^2)$ operations if information from the QZ decomposition of the linearization is used.

The goal is to develop a robust solver for unstructured polynomial eigenvalue problems that is not much more expensive than the current polyeig routine in MATLAB.

This is joint work with Nick Higham and Francoise Tisseur.