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Computating pseudospectra of parameter-dependent matrices

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The motivation for studying the matrix pseudospectrum is that it frequently provides information regarding matrix modeled processes that is not readily available from the spectrum. Only a few years ago, computing pseudospectra was considered to be very expensive even for moderately sized matrices. Recent research, however, has brought down the cost considerably and makes their computation feasible even for relatively large matrices. A general assumption in these efforts was that the matrix under study does not change. In this presentation we relax this constraint and consider the pseudospectrum of matrices that depend on parameters, such as time. Typical applications in which such matrices arise include the numerical solution of PDEs with time varying coefficients and bifurcation problems in dynamical systems using Newton-Krylov schemes. The objective is to design methods that follow the evolution, with t, of the pseudospectrum $\Lambda_\epsilon(A(t))$ of some matrix function $A(t)$. A recently designed method for the parallel computation of pseudospectra, called PSDM, will serve as a primary tool of these investigations.

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