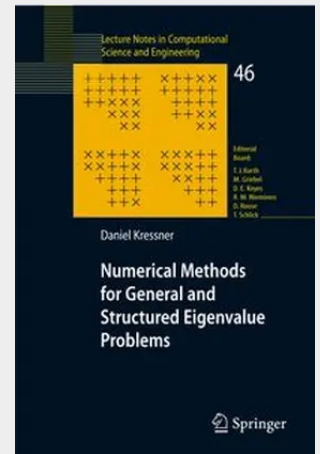


Numerical Methods for General and Structured Eigenvalue Problems

The purpose of this book is to describe recent developments in solving eig- value problems, in particular with respect to the QR and QZ algorithms as well as structured matrices. Outline Mathematically speaking, the eigenvalues of a square matrix A are the roots of its characteristic polynomial $\det(A - \lambda I)$. An invariant subspace is a linear subspace that stays invariant under the action of A . In realistic applications, it usually takes a long process of simplifications, linearizations and discretizations before one comes up with the problem of computing the eigenvalues of a matrix. In some cases, the eigenvalues have an intrinsic meaning, e.g., for the expected long-time behavior of a dynamical system; in others they are just meaningless intermediate values of a computational method. The same applies to invariant subspaces, which for example can describe sets of initial states for which a dynamical system produces exponentially decaying states. Computing eigenvalues has a long history, dating back to at least 1846 when Jacobi [172] wrote his famous paper on solving symmetric eigenvalue problems. Detailed historical accounts of this subject can be found in two papers by Golub and van der Vorst [140, 327].

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