Separable Type Representations of Matrices and Fast Algorithms: Volume 2 Eigenvalue Method (Operator Theory: Advances and Applications)

Yuli Eidelman, Israel Gohberg, Iulian Haimovici

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This two-volume work presents a systematic theoretical and computational study of several types of generalizations of separable matrices. The main attention is paid to fast algorithms (many of linear complexity) for matrices in semiseparable, quasiseparable, band and companion form. The work is focused on algorithms of multiplication, inversion and description of eigenstructure and includes a large number of illustrative examples throughout the different chapters.

The second volume, consisting of four parts, addresses the eigenvalue problem for matrices with quasiseparable structure and applications to the polynomial root finding problem. In the first part the properties of the characteristic polynomials of principal leading submatrices, the structure of eigenspaces and the basic methods to compute eigenvalues are studied in detail for matrices with quasiseparable representation of the first order. The second part is devoted to the divide and conquer method, with the main algorithms being derived also for matrices with quasiseparable representation of order one. The QR iteration method for some classes of matrices with quasiseparable of any order representations is studied in the third part. This method is then used in the last part in order to get a fast solver for the polynomial root finding problem. The work is based mostly on results obtained by the authors and their coauthors. Due to its many significant applications and the accessible style the text will be useful to engineers, scientists, numerical analysts, computer scientists and mathematicians alike.

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