THE QR-FACTORIZATION OF DIAGONAL-PLUS-SEMISEPARABLE MATRICES

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Abstract

Let D be a diagonal matrix and S a semiseparable matrix of semiseparability rank 1, i.e., a matrix whose lower triangular part is the lower triangular part of a rank 1 matrix and similarly for the upper triangular part. We show that the R-component of the QR-decomposition is the upper triangular part of a rank-2 matrix. This fact is used to design two variants of a fast algorithm for solving linear systems of equations where the coefficient matrix is a diagonal-plus-semiseparable matrix,

$$(D + S)x = b.$$

This algorithm requires $O(n)$ flops where n is the dimension of $D + S$. Numerical experiments show the accuracy and efficiency of the algorithm.