

Generic low rank perturbations of structured matrices

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Abstract

The effect of generic low rank perturbations on the Jordan structure of general matrices is well known. If the perturbation matrix has rank k , then for each eigenvalue the largest k Jordan blocks associated that eigenvalue will disappear while all other Jordan blocks associated with that eigenvalue will remain. Surprisingly, this behavior changes if generic structure-preserving perturbations are applied to matrices that have symmetry structures with respect to some indefinite inner product. Important examples include J -Hamiltonian matrices, i.e., real or complex $2n \times 2n$ matrices A that satisfy $A^*J + JA = 0$ for some invertible skew-symmetric matrix J . For such matrices it has been observed that sometimes Jordan blocks may generically grow in size after perturbation.

In this talk, we give an explanation for this surprising behavior by giving an overview over the theory of generic structure-preserving low rank perturbations of structured matrices. While the first part of the talk focusses on rank-one perturbations, the second part considers the case of perturbations of arbitrary rank k .

The talk is based on joined work with Leonhard Batzke, Volker Mehrmann, André C.M. Ran, and Leiba Rodman and is dedicated to the memory of Leiba Rodman.

Keywords

Hamiltonian matrices, Perturbations theory, Low rank perturbations, Generic perturbations.