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Low rank perturbation of regular matrix pencils with symmetry structures

Tuesday, September 2, 2025 3:00 PM (30 minutes)

We will analyze the generic change of the Weierstra\ss\ Canonical Form of regular complex structured matrix pencils under
generic structure-preserving additive low-rank perturbations. Several different symmetry structures are considered
and it is shown that, for most of the structures, the generic change in the eigenvalues is analogous
to the case of generic perturbations that ignore the structure.
However, for some odd/even and palindromic structures, there is a different behavior for the eigenvalues 0 and ∞,
respectively $+1$ and -1. The differences arise in those cases where the parity of the partial multiplicities in the perturbed
matrix pencil provided by the generic behavior in the general structure-ignoring case is not in accordance with the restrictions
imposed by the structure. The new results extend results for the rank-1 and rank-2 cases that were obtained in
previous works for the case of special structure-preserving perturbations. As the main tool, we use decompositions of
matrix pencils with symmetry structure into sums of rank-one matrix pencils, as those allow a parametrization of the set of matrix pencils
with a given symmetry structure and a given rank.

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