

# Low rank perturbations of spectral canonical forms

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Low rank perturbations of matrices appear very frequently in applied and theoretical problems. If a square matrix  $A$  is perturbed to a matrix  $A + E$ , where  $E$  has low rank, then its Jordan canonical form may change in a large variety of ways. However, a well defined typical change of the Jordan canonical form occurs for all perturbations  $E$  except those in a manifold of codimension 1. A similar behavior happens when a low rank perturbation is applied on a regular matrix pencil  $A + \lambda B$ : it is possible to identify a generic change of its Weierstrass canonical form. This change is rather different than the one appearing in the Jordan form of matrices. Finally, another generic variation arises in the Kronecker canonical form of singular matrix pencils perturbed by low rank pencils that preserve the singularity. Surprisingly, this variation of the Kronecker canonical form has nothing to do with the generic changes of Jordan and Weierstrass canonical forms. We will describe all these typical spectral changes and the generic conditions under which they appear.

**This is a joint work with Fernando de Terán and Julio Moro.**