Inverse eigenstructure problems for matrix polynomials

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Abstract

In this talk, we summarize several results on inverse eigenstructure problems for matrix polynomials that have been obtained recently in [Terán et al., to appear] and [Terán et al., submitted], and discuss how they complete other results previously known in the literature. Three key features of these new results are that they are valid for singular matrix polynomials, they consider prescribed minimal indices, in contrast to many inverse results in the literature which only deal with prescribed elementary divisors, and that certain degrees are also prescribed. In particular, we present necessary and sufficient conditions for the existence of a matrix polynomial when its degree, its finite and infinite elementary divisors, and its left and right minimal indices are prescribed, and necessary and sufficient conditions for the existence of dual minimal bases with prescribed row-degrees. In both cases, these necessary and sufficient conditions are determined mainly by the so called "index sum theorem". In addition, the solutions we present of the inverse problems mentioned above are constructive and are based on a new class of sparse, structured matrix polynomials that we have baptized as polynomial zigzag matrices.

Keywords

Matrix polynomials, Minimal indices, Minimal bases, Inverse problems

References

Terán, F. De, Dopico, F. M. and Van Dooren, P. *Matrix polynomials with completely prescribed eigenstructure*, to appear in SIAM Journal on Matrix Analysis and Applications.

Terán, F. De, Dopico, F. M., Mackey, D. S. and Van Dooren, P. *Polynomial zigzag matrices, dual minimal bases, and the realization of completely singular polynomials*, submitted.