Structured backward stability of linearizations of polynomial matrices

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In this talk we discuss the structured backward stability of linearizations of a given polynomial matrix $P(\lambda)$ that can be given either in: (i) the classical monomial basis, (ii) the Chebyshev basis, or, (iii) the barycentric Lagrange basis with given interpolation points. We show that for these different classes of linearizations, running the QZ algorithm on the linearized pencil yields a relative backward error on the pencil that can be mapped back to a relative backward error of essentially the same size on the coefficients of the original representation. In that sense we can say that the computed roots correspond exactly to the roots of a nearby polynomial matrix where "nearness" has to be interpreted in the coefficient space of the representation being used. The proofs of these results rely, to a certain extent, on the concept of dual minimal bases as developed in [1], [2].

References

[1] F. De Terán, F. M. Dopico, P. Van Dooren, *Matrix polynomials with completely prescribed eigenstructure*. accepted for publication in SIAM J. Matr. Anal. Appl., 2014

[2] F. De Terán, F. M. Dopico, D. S. Mackey, P. Van Dooren, *Polynomial zigzag matrices, dual minimal bases and the realization of completely singular polynomials*. preprint, 2014.