

Linearizations of polynomial and rational matrices

Paul van Dooren¹

¹*Catholic University of Louvain, Belgium*

Abstract

We show that the problem of linearizations of polynomial and rational matrices is closely related to the polynomial matrix quadruples introduced by Rosenbrock in the seventies to represent rational transfer functions of dynamical systems. We also recall the concepts of irreducible and strongly irreducible quadruples which were introduced in the eighties, and show how they relate to the linearizations that are more common in the numerical linear algebra community. We then show that the family of strong linearizations of matrix polynomials, called “block Kronecker pencils”, as well as their extension to rational eigenvalue problems, nicely fit in that general framework. The novelty of these block Kronecker pencils is that they can be proven to be backward stable in a structured sense, for the polynomial matrix case as well as for the rational matrix case.

This is based on joint work with F. Dopico (UC3M), P. Lawrence (KULeuven), J. Perez (UMontana) and M.C. Quintana (UC3M).
