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Solving rational eigenvalue problems through linearizations

Rational matrices R(x) arise in many applications such as in vibration analysis of machines, buildings and vehicles, in Control Theory and Linear Systems Theory, and in approximation of other nonlinear eigenvalue problems. The spectral data (poles, zeros, eigenvalues, eigenvectors, minimal bases, and minimal indices) of R(x) play a vital role in many applications. In order to provide a direct solution to the rational eigenvalue problems, in this talk, we propose a method called “Linearization” (specifically, Rosenbrock strong linearization) of rational matrices: by Rosenbrock strong linearization of a rational matrix R(x) we mean a matrix pencil L(x) preferably of smallest dimension that reveals the spectral data of R(x). Then, in order to validate our definition of linearization, we discuss the construction of various families of linearizations for structured and unstructured rational matrices. Finally, we establish the relation of spectral data between the rational matrices and the linearizations.

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