Working with rational functions in a numeric environment - some contributions

Ana Matos
University of Lille - France

Rational functions like for instance Padé approximants play an important role in signal processing, sparse interpolation and exponential analysis. They have good theoretical properties in approximation and modeling. However, for a successful modeling with help of rational functions we want to make sure that there is no "similar" rational function being degenerate, i.e., having strictly smaller degree of both degrees of numerator and denominator. In particular, we prefer having rational functions without Froissart doublets (i.e., roots close to a pole) because their presence induce numerical instabilities: small variations in the argument of the function give rise to large variations in the function values.

In a numerical setting, we will bring out some quantities to control conditioning and stability of the computed rational functions. These quantities are based on the condition number of some matrices, numerical co-primeness of polynomials and spherical derivatives. They are reliable indicators of the good numerical properties of the functions and we can use them to choose the good class of functions or to construct new approximations.