

Robust Stability Analysis Using Fast Fourier Transform

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Abstract: When dealing with uncertain systems stability is the most important issue which must be taken into account. Since publishing the celebrated Kharitonov theorem few decades ago several interesting results concerning robust stability analysis of systems with parametric uncertainty have been developed. Elegant results have been achieved for interval systems and systems with linear parameter dependency. Nevertheless in most practical applications more general parameter uncertainties appear such as with multilinear or polynomial dependency. In those cases general stability criteria such Hurwitz or Schur are often used. The criteria are based on computation of determinant of a multivariate polynomial matrix.

There are few ways how to do this job. The classical ones are based on algebraic manipulations with multivariate polynomials. The result is accurate but the evaluation takes a lot of time. In this contribution modern method based on interpolation-evaluation techniques is presented. The procedure uses interpolation points evenly distributed on unit circle in the complex plane which makes it possible to utilize multiple fast Fourier transform (FFT) algorithm resulting in highly efficient performance of the proposed procedure which is demonstrated on a benchmark example.

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