Computer algebra methods for the stability of some classes of linear systems

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Abstract

A fundamental question in the study of dynamical systems cencernes their stability which is a necessary condition for the latters to work properly. At the core of the effective study of such a property, is the problem of checking the stability as well as the problem of computing stabilizing controllers for unstable systems.

In the case of linear systems, within the frequency domain, i.e. considering the transfer function representation, the stability property translates as the absence of poles of the transfer function in some regions of the complex space. While such a condition is easy to check for finite dimensional system using for example the classical *Routh-Hurwitz* criterion and its multiple analogues, it becomes rather complicated for infinite dimensional systems such as time delay systems, two-dimensional systems, etc.

In the present talk, we provide a new computer algebra framework for testing the stability of some classes of infinite dimensional linear systems, namely, linear time-delay systems with commensurate delays and two-dimensional discrete linear systems. The idea behind consists in transforming the stability conditions into algebraic conditions and then to use techniques for solving algebraic systems to process the latters. Using similar techniques, we also show how can be computed stabilizing controllers for these classes of system.

Our methods are illustrated through simple and practical examples.

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