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Title: Subspace Method for Approximation of H-infinity Norms of Large-Scale Control Systems

Short Description:

I will shortly describe and formulate the problem of the computation of H-infinity norm of a given control system such as descriptor system or time-delay system. Then, I will review some existent methods in literature. Afterward, I will introduce our subspace method and explain how to employ it to approximate the H-infinity or more generally L-inifnity norm of large-scale control systems. I will give the main result which states that our subspace method converges superlinearly assuming that it converges at least locally. Finally, I will demonstrate several numerical results that verify the fast convergence and efficiency of our method.

Abstract:

We are concerned with the computation of the H-infinity norm for H-infinity functions of the form H(s) = C(s)D(s)^-1B(s), where the middle factor is the inverse of an analytic matrix- valued function, and C(s), B(s) are analytic functions mapping to short-and-fat and tall- and-skinny matrices, respectively. For instance, transfer functions of descriptor systems and delay systems fall into this family. We focus on the case where the middle factor is very large. We propose a subspace projection method to obtain approximations of the function H where the middle factor is of much smaller dimension. The H-infinity norms are computed for the resulting reduced functions, then the subspaces are refined by means of the optimal points on the imaginary axis where the largest singular value of the reduced function is maximized. The subspace method is designed so that certain Hermite interpolation properties hold between the largest singular values of the original and reduced functions. This leads to a superlinearly convergent algorithm with respect to the subspace dimension, which we prove and illustrate on various numerical examples.