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Improved algorithm for computing the domain of attraction of rational nonlinear systems

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Abstract

An improved method for computing a bounded estimate of the domain of attraction (DOA) of locally asymptotically stable uncertain rational nonlinear system models is proposed in this paper. The approach is based on the previous work of Trofino and Dezuo (2013). Using linear fractional transformation and an additional simplification step, we give a novel automatic method for generating the rational terms to be considered in the Lyapunov function, which satisfy the requirements for system representation. Moreover, we give an algorithm for computing the so-called maximal annihilators, which contain the maximum number of linearly independent rows corresponding to a given feasibility domain. As the illustrative examples show, the proposed method effectively reduces the size of the resulting optimization problem without increasing the conservatism of the DOA computation.

Keywords: nonlinear systems, uncertain systems, stability, Lyapunov functions, domain of attraction, linear matrix inequalities,
2000 MSC: 37B25

1. Introduction

Approximating the domain of attraction (DOA) is often a fundamental task in model analysis and controller design/evaluation. The stability proper-

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