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A global rational Arnoldi method for model reduction

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Abstract

In this paper, we propose two new approaches for model order reduction of large-scale multi-input multi-output (MIMO) linear time invariant dynamical systems (LTI). These methods are based on a generalization of the global Arnoldi algorithm which is used to generate projection subspaces. An adaptive procedure for the selection of shift parameters is proposed and some simple Arnoldi relations are established in order to compute error bounds on the transfer function. Numerical experiments showing the effectiveness of these approaches are provided.

Keywords: Matrix Krylov subspaces, Model reduction, Dynamical systems.

subclass MSC 65F10, MSC 65F30

1. Introduction

Consider the multi-input multi-output (MIMO) linear time-invariant (LTI) system described by the state-space equations

$$\begin{cases} \dot{x}(t) &= Ax(t)+Bu(t) \\ y(t) &= Cx(t), \end{cases} \tag{1}$$

where $x(t) \in \mathbb{R}^n$ denotes the state vector and $u(t), y(t) \in \mathbb{R}^p$ respectively denote the input and output vectors of the system (1), where the dimension n of the state-space is called order of the system (1). The matrix $A \in \mathbb{R}^{n\times n}$ is assumed to be large and sparse, and B, $C^T \in \mathbb{R}^{n\times p}$.

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