Abstract

This thesis gives some new results in model order reduction and controller design of linear time-invariant systems. A formulation for the Padé type model order reduction of linear time-invariant single-input single-output(SISO) systems via generalised moment matching at some selected general expansion points is given. New criterion for the selection of optimal expansion points by examining dominant dynamics of the high order system has been given. The expansion points selected by the proposed method yield good results. Reduced order controller design by generalised moment matching involves the evaluation of dominant poles of the closed loop system with the original high order controller. New mixed Padé type stability preserving frequency domain model order reduction methods have been proposed. The results have been compared with some standard methods like balanced realization. The methods developed for SISO systems have been extended to linear time-invariant multi-input multi-output(MIMO) systems as well. The reduced order model of the high order MIMO systems has been obtained in a special state space form. The input can be in the form of a transfer function matrix or in the state space form. Another model order reduction method for SISO systems which involves the use of a special class of persistently exciting input signals has been proposed. The method has been used to reduce the order of significantly higher order benchmark models to low order models. This method also has been extended to the MIMO case. A simple algebraic method to design low order controllers for linear SISO systems based on proposed generalised moment matching has been developed. The method has been extended to design of MIMO controllers which result in reasonably non-interacting closed loop system.

Key words: Model Order Reduction, Generalised Moment Matching, Controller Design.