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INFORMS Seminar Series

Iterative Rational Krylov Algorithm for Unstable Dynamical Systems and Structure-preserving Model Reduction

SEMINAR SESSION INFORMATION

DATE: Wednesday, Sep. 28th

TIME: 12:15pm

LOCATION: Whittemore 542

PROVIDED: Pizza and Soda

SPEAKER INFORMATION

Klajdi Sinani
PhD Student

The Department of Mathematics at VT

MEMBERSHIP INFORMATION

Fees are as follows and include all weekly seminars (22+) & workshops.

FIRST MEETING: FREE
MEETING: $5
SEMESTER: $25
YEAR: $40

Generally, large-scale dynamical systems pose tremendous computational difficulties when applied in numerical simulations. In order to overcome these challenges we use several model reduction techniques. For stable linear models these techniques work very well and provide good approximations for the full model. However, large-scale unstable systems arise in many applications. Many of the known model reduction methods are not very robust, or in some cases, may not even work if we are dealing with unstable systems. When approximating an unstable system by a reduced order model, accuracy is not the only concern. We also need to consider the structure of the reduced order model. Often, it is important that the number of unstable poles in the reduced system is the same as the number of unstable poles in the original system. The Iterative Rational Krylov Algorithm (IRKA) is a robust model reduction technique which is used to locally reduce stable linear dynamical systems optimally in the $\mathcal{H}_2$-norm. While we cannot guarantee that IRKA reduces an unstable model optimally, there are no numerical obstacles to the reduction of an unstable model via IRKA. In this thesis, we investigate IRKA's behavior when it is used to reduce unstable models. We also consider systems for which we cannot obtain a first order realization of the transfer function. We can use Realization-independent IRKA to obtain a reduced order model which does not preserve the structure of the original model. In this paper, we implement a structure preserving algorithm for systems with nonlinear frequency dependency.

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Questions? Comments? Send an e-mail to shafae1@vt.edu