APPLIED MATHEMATICS COLLOQUIUM

MODEL REDUCTION OF LARGE DYNAMICAL SYSTEMS

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ABSTRACT:

We describe model reduction techniques for large scale dynamical systems, modeled via generalized state-space systems

\[
\begin{aligned}
E \dot{x}(t) &= Ax(t) + Bu(t) \\
y(t) &= Cx(t) + Du(t),
\end{aligned}
\]

with input \( u(t) \in \mathbb{R}^m \), state \( x(t) \in \mathbb{R}^N \) and output \( y(t) \in \mathbb{R}^p \). These models arise from the discretization of continuum problems and correspond to sparse systems of equations \( \{E, A, B, C, D\} \). The state dimension \( N \) is typically very large, while \( m \) and \( p \) are usually reasonably small. Although the numerical simulation of such systems may still be viable for large state dimensions \( N \), most control problems of such systems are of such high complexity that they require model reduction techniques, i.e. techniques that construct a lower order model via a projection on a state space of lower dimension. We survey such techniques and discuss extensions to interconnected and mechanical systems as well as time-varying system models.

Monday, March 29, 2004
4:15 p.m.

M.I.T. Room 2-105

Refreshments will be served at 3:30 PM in Room 2-349.

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