Abou Jaoude, Dany; **Farhood, Mazen**

Model reduction of distributed nonstationary LPV systems. (English) Zbl 1403.93055

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Summary: This paper is on the structure-preserving model reduction of distributed systems formed by heterogeneous, discrete-time, nonstationary linear parameter-varying subsystems interconnected over arbitrary directed graphs. The subsystems are formulated in a linear fractional transformation (LFT) framework, and a communication latency of one sampling period is considered. The balanced truncation method is extended to the class of systems of interest, and upper bounds on the ℓ_2-induced norm of the resulting error system are derived. Balanced truncation suffers from conservatism since it only applies to stable systems which possess structured solutions to the generalized Lyapunov inequalities. The coprime factors reduction method is then provided as a partial remedy to this conservatism. An illustrative example is given to demonstrate the efficacy of the proposed approaches.

MSC:

93B11 System structure simplification
93C55 Discrete-time control/observation systems
93B28 Operator-theoretic methods
93C05 Linear systems in control theory

Keywords:

structure-preserving model reduction; balanced truncation; coprime factors reduction; linear parameter-varying systems; linear time-varying systems; interconnected systems

Software:

YALMIP; Stony Brook; SDPT3

Full Text: DOI

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