Robust Observed-State Feedback Design for Discrete-Time Systems Rational in the Uncertainties

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Abstract

Design of controllers in the form of a state-feedback coupled to a state observer is studied in the context of uncertain systems. The classical approach by Luenberger is revisited. Results provide a heuristic design procedure that mimics the independent state-feedback / observer gains design by minimizing the coupling of observation error dynamics on the ideal state-feedback dynamics. The proposed design and analysis conditions apply to linear systems rationally-dependent on uncertainties defined in the cross-product of polytopes. Convex linear matrix inequality results are given thanks to the combination of a new descriptor multi-affine representations of systems and the $S$-variable approach. Stability and $H$-infinity performances are assessed by multi-affine parameter-dependent Lyapunov matrices.

Biographical Information

Dimitri Peaucelle received the "Diplôme de Doctorat" (Ph.D. degree) from the Paul Sabatier University, Toulouse, France, in 2000 and the “Habilitation à Diriger des Recherches” (French Habilitation) degree from that same university in December 2014. Since 2001 he is CNRS researcher at Laboratory for Analysis and Architecture of Systems (LAAS) in Toulouse, France. His research interests are in robust control, and extend to convex optimization over linear matrix inequalities (LMIs), periodic systems, time-delay systems and direct adaptive control. He is also involved in computer-aided control design activities and is the main contributor to the Randomized and Robust Multi-Objective Control (R-RoMuLOC) Toolbox. He has been involved in several industrial projects with aerospace partners for launcher, aircraft, and satellite robust control. More information at http://homepages.laas.fr/peaucell.