Master Informatique, Mathématiques, Multimédia & Télécommunications
Spécialité « informatique »
Spécialité « Réseaux de Télécommunications, Multimédia et Automatique »

Proposition de sujet de Stage Recherche 2017-2018

Titre : identification for robust control: a MATLAB toolbox

Laboratoire : LIAS - ENSIP

Encadrant(s) : Olivier Bachelier et Guillaume Mercère

Mots clés : data-driven modeling, robust control, uncertainty, Linear Fractional Rerpresentation

Sujet : The problem of marrying system identification and robust control is still an active research area in automatic control [Gev05, Lju10, OB12]. Indeed, as explained, *e.g.*, in [Gev97b], "the recent research effort has focused on establishing synergies between identification and robust control design" with a specific attention to reliable low order model with frequency domain uncertainty model descriptions in order to ensure that the low order controller designed from this model matches the user-defined control performance (stability and robustness mainly). The final solution is thus an iterative approach composed of a succession of model and controller refinement. The main difficulties with such an iterative approach are mainly

- the lack of knowledge of the real plant in the loop, its optimal controller as well as, in some practical cases, the present controller in the current closed-loop process,
- the difficulty to translate the control-oriented identification problem into a cost function which can be minimized in an efficient way without a too high computational demand,
- the inappropriate use of probabilistic model error descriptions (yielded by standard data-driven modeling techniques) in a robust control framework.

The main goal of this project is to focus on the interplay between system identification and robust control. A specific attention will be paid to

- the requirements on the identified model sets introduced by the robust control performance,
- the description of the model uncertainties in a "deterministic manner" (The robust controller designer is waiting for dedicated frequency domain uncertainty descriptions with hard bounds while the first solutions in the system identification yield error models described by ellipsoidal uncertainty regions, a shape which is easy related to the positive definite covariance matrix of the estimated parameters),
- the importance of the iterative model and controller update approach.

In this project, the student will be asked to develop such an iterative approach with, as a deliverable, reliable functions implemented on MATLAB.

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[OB12] System identification for achieving robust performance, T. Oomen and O. Bosgra, Automatica, (48) 2012, pp. 1975--1987

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