Groupe de Travail Systèmes A Retards (SAR)

Réunion du 13 mai 2016

MINES ParisTech
60 Bd St-Michel, 75006 Paris, Salle V112
Information utile : voir plan d'accès

Programme

10h30 Accueil

10h45–11h30 Prediction-based control for systems with state- and input- delays – robustness to delays mismatch
Delphine Bresch-Pietri (GIPSA-Lab), Nicolas Petit

11h30–12h15 Coalescence of characteristic roots of time-delay systems: A link with stable manifold
Islam Boussaada (IPSA, L2S), Silviu-Iulian Niculescu, Hakki Unal

12h15 Repas

14h00–14h45 Stability analysis of a system coupled to a transport equation using integral inequalities
Lucie Baudouin, Mohammed Safi (LAAS) and Alexandre Seuret

14h45–15h30 Computer algebra methods for the stability analysis of differential systems with commensurate time-delays
Yacine Bouzidi (INRIA), Adrien Poteaux, Alban Quadrat

15h30–16h15 Stability Analysis of Dynamic Output Controllers under Aperiodic Sampling and Input Saturation
Joao Manoel Gomes da Silva Jr, Isabelle Queinnec, Alexandre Seuret (LAAS), Sophie Tarbouriech

16h15–16h45 Points divers

Prediction-based control for systems with state- and input- delays – robustness to delays mismatch
Delphine Bresch-Pietri (GIPSA-Lab), Nicolas Petit

Résumé: In this talk, we are interested in the design of prediction-based controller for systems subject to both state- and input-delays, which appear frequently in the process and biological fields. We present recent results obtained respectively for linear and nonlinear systems and for pointwise and distributed state delays, respectively. We show how our PDE-inspired analysis approach enables to study the robustness to delays uncertainties. We illustrate the merits of this class of controller on a prey-predator population dynamics.

Coalescence of characteristic roots of time-delay systems: A link with stable manifold
Islam Boussaada (IPSA, L2S), Silviu-Iulian Niculescu, Hakki Unal

Résumé: Multiple spectral values in dynamical systems are often at the origin of complex behaviors as well as unstable solutions. However, in some recent studies, an unexpected property is emphasized. More precisely, an example of delay system is constructed, where the maximal multiplicity of an appropriate delay-dependant negative spectral value leads to a negative spectral abscissa and, as a consequence, the asymptotic stability of the corresponding steady state solution holds. In algebraic terms, the manifold corresponding to such a multiple root defines a stable manifold for the steady state. Furthermore, for the illustrative examples we consider, we show that, under mild assumptions, such a multiple spectral value is nothing but the spectral abscissa. Motivated by the potential implication of such a property in control systems applications, this study is devoted to better explore the connexion between those manifolds.

Stability analysis of a system coupled to a transport equation using integral inequalities
Lucie Baudouin, Mohammed Safi (LAAS) and Alexandre Seuret

Résumé: In this paper, we address the stability of a system of ordinary differential equations coupled with a transport partial differential equation, using a Lyapunov functional approach. This system can also be interpreted as a finite dimensional system subject to a state delay. Inspired from recent developments on time-delay systems, a novel method to assess stability of such a class of coupled systems is developed here. We will specifically take advantage of a polynomial approximation of the infinite dimensional state of the transport equation together with efficient integral inequalities. The main result of this paper provides stability conditions expressed in terms of linear matrix inequalities and the results are tested on academic examples.

Computer algebra methods for the stability analysis of differential systems with commensurate time-delays
Yacine Bouzidi (INRIA), Adrien Poteaux, Alban Quadrat

Résumé: In this presentation, we study the stability of linear differential systems with commensurate delays. Within the frequency-domain approach, it is well-known that the asymptotic stability of such systems is ensured by the condition that all the roots of the corresponding quasipolynomial have negative real parts. A classical approach for checking this condition consists in computing the set of critical zeros of the quasipolynomial, i.e., the roots (and the corresponding delays) of the quasipolynomial that lie on the imaginary axis, and then analyzing the variation of these roots with respect to the variation of the delay. Following this approach, based on solving algebraic systems techniques, we propose a certified and efficient symbolic-numeric algorithm for computing the set of critical roots of a quasipolynomial. Moreover, using recent algorithmic results developed by the computer algebra community, we present an efficient algorithm for the computation of Puiseux series at a critical zero which allows us to finely analyze the stability of the system with respect to the variation of the delay. Explicit examples are given in order to illustrate our algorithms.

Stability Analysis of Dynamic Output Controllers under Aperiodic Sampling and Input Saturation
Joao Manoel Gomes da Silva Jr, Isabelle Queinnec, Alexandre Seuret (LAAS), Sophie Tarbouriech

Résumé: This paper addresses stability issues of sampled-data controllers. Considering a continuous-time linear plant and a linear discrete-time dynamic output feedback control law designed from a classical periodic sampling paradigm, the main goal is to assess the effects of aperiodic sampling on the closed-loop stability. This aperiodic sampling models for instance the communication delays and package losses through a network. In addition, the effects of control signal saturation on the stability and the maximal admissible sampling interval are also taken into account . In this context, based on the use of a looped functional, linear matrix inequalities (LMI) are derived to ensure the global asymptotic stability of the origin for the aperiodic sampled-data closed-loop system, provided a bound on the maximal sampling interval is given. An optimization problem in order to evaluate the maximal admissible value for the interval between two sampling instants is then associated to the LMI conditions.