Groupe de Travail Systèmes A Retards (SAR)

Réunion du 26 septembre 2014

LSS-Supelec
Salle du Conseil, 4ème étage
Information utile : voir plan d'accès

Programme

9h30 Accueil

9h45–10h30 On the Multiplicity of Zero Spectral Value in Networks with Delays
Islam Boussaada, Dina Irofti (LSS), Silviu-Iulian Niculescu

Résumé: Continuous-time dynamical networks with delays have a wide range of application fields from biology, economics to physics and engineering sciences. Usually, two types of delays can occur in the network: internal delays (due to specific internal dynamics of a given node) and external delays (delays involved in the communication process, due to the information transmission and processing). Besides, such delays can be totally different from one node to another. This is why it is somewhat challenging to analyze the stability of such systems, especially when a huge number of delays are taken into account. However, this analysis relies much on the identification and the understanding of the spectral values bifurcations when crossing the imaginary axis. There are several approaches for identifying the imaginary crossing roots, though, to the best of the author's knowledge, the bound of the multiplicity of such roots has not been deeply investigated so far. We shall provide an answer for this question in the case of multi agent systems with time-delay, where the corresponding quasi-polynomial function has non-sparse polynomials and no coupling delays.

10h30–11h15 Conception optimale et commande d'une interface haptique à retour d'effort
Quoc-Viet Dang, Antoine Dequidt, Laurent Vermeiren, Michel Dambrine (LAMIH)

Résumé: Les interfaces haptiques à retour d'effort sont des dispositifs robotiques capables de reproduire des forces à destination de l'utilisateur dans les applications de réalité virtuelle. Les effets du retard sur ses performances (la stabilité et la transparence) ne sont pas négligeables si des performances élevées sont attendues. Ces effets doivent être pris en compte lors de la conception d'une interface haptique (le cas d'un dispositif à 1 degré de liberté sera utilisé à titre d'illustration) interagissant avec un environnement virtuel. Une condition de stabilité prenant en compte les effets du retard ainsi que d'autres paramètres mécaniques et exprimée en termes d'inégalité matricielle linéaire (LMI) permet de ramener la conception sous forme d'un problème d'optimisation. A l'aide d'une condition de stabilité asymptotique pour les systèmes en temps discret à retard variable et en utilisant un observateur d'état augmenté comme alternative à l'utilisation standard de la méthode des différences finies arrières dans le domaine haptique, la synthèse d'une architecture de commande est proposée permettant d'améliorer les performances du système. Enfin, quelques résultats expérimentaux sur un banc d'essai sont présentés pour valider l'approche théorique.

11h15–12h00 Implicit Lyapunov-Krasovski Functionals for Time Delay Systems
Andrey Polyakov (INRIA, LAGIS), Denis Efimov, Wilfrid Perruquetti, Jean-Pierre Richard

Résumé: The method of Implicit Lyapunov-Krasovski Functional (ILKF) for stability analysis of time-delay systems is introduced. Theorems on Lyapunov, asymptotic, (hyper) exponential, finite-time and fixed-time stability analysis using ILKF are presented. The hyper exponential stabilization algorithm is designed for a linear system with state delays. The theoretical result is supported by numerical simulation.

12h Repas

14h00–14h45 A convex optimization approach to control of infinite-dimensional systems
Emilia Fridman (Tel Aviv University)

Résumé: Two main approaches are usually used for stability and control of infinite- dimensional systems: the analysis of the abstract infinite-dimensional system (e.g. in the Hilbert space) with the corresponding conclusions for specific systems or the direct approach to a specific system. In this talk both approaches to Lyapunov- based analysis will be presented. We will start with the Linear Operator Inequalities (LOIs) for the stability of linear time-delay systems in a Hilbert space. The decision variables of LOIs are operators in the Hilbert space. Being applied to a scalar heat equation and to a scalar wave equation, these conditions are reduced to standard finite-dimensional Linear Matrix Inequalities (LMIs). Then the direct approach for the sampled-data control of semilinear heat and to control/estimation of semilinear wave/beam PDEs will be discussed. As it happened with time-delay systems, an LMI approach is expected to provide effective tools for robust control of distributed parameter systems.
The talk will start with a very short presentation of the book
`http://www.springer.com/birkhauser/mathematics/book/978-3-319-09392-5`.

14h45–15h30 Approximation of distributed parameter systems
Michael Di Loreto (Ampère), Sérine Damak

Résumé: In this talk, we address the approximation problem for linear distributed parameter systems by classes of linear dynamical systems. Roughly speaking, we seek to replace the initial (infinite-dimensional) model by another more tractable model. Starting from performances requirements in interconnection structure, we analyze a graph-topology for dynamical systems, and we give necessary and sufficient conditions for the existence of such an approximation, which satisfies performances specifications. The approximated models are taken into the classes of lumped systems or difference-differential systems. A numerical method for the approximation synthesis is proposed and illustrated by simulation results.

15h30–16h00 Discussion et points divers