HANDY MEETING December 3, 2020

PROGRAM

13h30: S. Mariano, I.C. Morarescu, R. Postoyan, and L. Zaccarian. *A hybrid model of opinion dynamics with memory-based connectivity*
13h50: R. Bertollo, E. Panteley, R. Postoyan, L. Zaccarian. *Uniform global asymptotic synchronization of Kuramoto oscillators via hybrid coupling*
14h15: R. Vizuete, P. Frasca, E. Panteley. *On the influence of noise in randomized consensus algorithms*
14h35: *Coffee, Handy web page presentation (L. Zaccarian), Open discussions*
14h55: M. A. Maghenem, A. Loria, E. Nuño, and E. Panteley. *Distributed full-consensus control of nonholonomic vehicles under non-differentiable measurement delays*
15h15: F. Garin, A. Kibangou. *Generic delay-L left-invertibility of structured systems*
15h40: W. Wang, D. Nesic, R. Postoyan, M. Heemels. *A unifying event-triggered control framework based on a hybrid small-gain theorem*

ABSTRACTS

A hybrid model of opinion dynamics with memory-based connectivity
Authors: S. Mariano, I.C. Morarescu, R. Postoyan, and L. Zaccarian
Link to paper: https://hal.inria.fr/hal-02545383/
Abstract: Given a social network where the individuals know the identity of the other members, we present a model of opinion dynamics where the connectivity among the individuals depends on both their current and past opinions. Thus, their interactions are not only based on the present states but also on their past relationships. The model is a multi-agent system with active or inactive pairwise interactions depending on auxiliary state variables filtering the instantaneous opinions, thereby taking the past experience into account. When an interaction is (de)activated, a jump occurs, leading to a hybrid model. The proven stability properties ensure that opinions converge to local agreements/clusters as time grows. Simulation results are provided to illustrate the theoretical guarantees.

Uniform global asymptotic synchronization of Kuramoto oscillators via hybrid coupling
Authors: R. Bertollo, E. Panteley, R. Postoyan, L. Zaccarian
Link to paper: https://hal.archives-ouvertes.fr/hal-02562689
Abstract: Using a hybrid framework, we propose a generalized version of the well-known Kuramoto model for interconnected oscillators. The proposed model does not modify the classical model close to the synchronization set, but avoids the typical non-uniform convergence phenomenon. For the two-oscillators case, we prove the uniform global asymptotic stability of the consensus set by using a hybrid Lyapunov function whose generality promises possible extension of the result to higher order dynamics. We comparatively illustrate the achieved

uniform convergence properties by simulating both the case with two and multiple oscillators, thus confirming the effectiveness of our approach.

On the influence of noise in randomized consensus algorithms
Authors: R. Vizuete, P. Frasca, E. Panteley.
Link to paper: https://hal-centralesupelec.archives-ouvertes.fr/hal-02899936
Abstract: In this paper we study the influence of additive noise in randomized consensus algorithms. Assuming that the update matrices are symmetric, we derive a closed form expression for the mean square error induced by the noise, together with upper and lower bounds that are simpler to evaluate. Motivated by the study of Open Multi-Agent Systems, we concentrate on Randomly Induced Discretized Laplacians, a family of update matrices that are generated by sampling subgraphs of a large undirected graph. For these matrices, we express the bounds by using the eigenvalues of the Laplacian matrix of the underlying graph or the graph's average effective resistance, thereby proving their tightness. Finally, we derive expressions for the bounds on some examples of graphs and numerically evaluate them.

Distributed full-consensus control of nonholonomic vehicles under non-differentiable measurement delays
Authors: M. A. Maghenem, A. Loria, E. Nuño, and E. Panteley
Link to paper: https://hal.archives-ouvertes.fr/hal-02901395
Abstract: We address the problem of consensus control of second-order nonholonomic systems via distributed control under the assumption that each vehicle receives measured states from a set of neighbors, with a bounded, time-varying, but non-differentiable delay. The controller that we propose guarantees full consensus, in the sense that a common consensus point may be reached both in the Cartesian positions on the plane and the orientations of all robots referred to a fixed frame. Our controller is smooth, hence time-varying. Notably, it relies on a property of persistency of excitation. Our main statement guarantees uniform global asymptotic stability. Also, we provide some simulation results to illustrate our theoretical findings.

Generic delay-L left-invertibility of structured systems
Authors: F. Garin and A. Kibangou
Link to paper: https://hal.inria.fr/hal-02307596
Abstract: This talk concerns structured systems, namely linear systems where the state-space matrices have zeros in some fixed positions, and free parameters in all other entries. In particular, it focuses on discrete-time LTI systems affected by an unknown input.
The goal is to study delay-L left invertibility, namely the possibility to reconstruct the input sequence from the output sequence, assuming that the initial state is known, and requiring that the inputs can be reconstructed at least up to L time steps before the current output.
Under the assumption that the unknown input is scalar, this talk presents a simple graphical condition characterizing the structured systems which are generically delay-L left-invertible. Partial results are then discussed for the case where the input is not scalar.

A unifying event-triggered control framework based on a hybrid small-gain theorem

Authors: Wei Wang, Dragan Nesic, Romain Postoyan, and Maurice Heemels

Link to paper: https://hal.archives-ouvertes.fr/hal-02934369

Abstract: We propose a unifying emulation-based design framework for the event-triggered control of nonlinear systems that is based on a hybrid small-gain perspective. We show that various existing event-triggered controllers fit the unifying perspective. Moreover, we demonstrate that the flexibility offered by our approach can be used for the development of novel event-triggered schemes and for a systematic modification and improvement of existing schemes. Finally, we illustrate via a simulation example that these novel and/or modified event-triggered controllers can lead to a reduction in the required number of transmissions, while still guaranteeing the same stability properties.