PhD Proposal

A hybrid systems approach to open multi-agent dynamics

Supervisors: Elena Panteley, Paolo Frasca

E-mails: elena.panteley@l2s.centralesupelec.fr, paolo.frasca@gipsa-lab.fr

Duration: 3 years

Salary: full salary (= 1500 euros per month after taxes) + insurances

Key dates: For full consideration, contact the potential supervisors no later than May 15, 2019.

Starting date: Flexible, the position is available immediately.

Context: This work will be carried out in collaboration between L2S (Paris) and GIPSA-lab (Grenoble), France. Both L2S and GIPSA are leading research institutions in the broad field of signals and systems. The student will be enrolled in the ED STIC doctoral school of Paris-Saclay University with main attachment to the Laboratory of Signals and Systems. She/ will be mainly be based at L2S but shall also spend a significant portion of time at GIPSA-lab. The position is funded by the ANR 2018 project HANDY “Hybrid And Networked Dynamical sYstems”, supported by the French national scientific foundation (ANR).

Candidate profile: The candidate will have a MS degree in Applied Mathematics, Control Systems, Electrical Engineering, or related disciplines.

Topic description: The topic of the thesis combines mathematical systems theory, and in particular the theory of Hybrid Systems, with networks and multi-agent systems. Control-theoretic methods for networks often assume the network structure to be static. While on a short time scale this assumption can be made, on a longer time scale the network is bound to change due to the addition or removal of both nodes and arcs [HM17]. In many applications, including online social networks and modern power networks, the set of the nodes can change with time, as new members can join the network and some others can leave it. We will explore several possible approaches to analyze such networks in the framework of hybrid systems, by modeling the arrival/departure of a node as a jump in the state of the overall system and a change of the connectivity matrix of the system. One possible approach is to fix a maximal dimension of the network and distinguish active and inactive nodes. Another challenging situation is when the dimension of the system is not known in advance: such evolutions do not constitute “dynamical systems” according to standard notions and additionally the arrival or departure of agents persistently excites the system, preventing it from reaching any equilibrium state. In order to overcome these issues, we intend to define notions of trajectories that are more general than those available in the literature and prove results of approximate stability and ultimate boundedness of such trajectories.

Bibliography: