PhD Position in Automatic Control at University of Lille, France

**Project Title:** "Finite time observation of networks of nonlinear time delay systems"

**Keywords:** networks of nonlinear time delay systems, sliding mode observers, finite time impulsive observers.

A fully funded PhD position is available under collaborated supervision between the SHOC team of the laboratory CRIStAL, Lille and the Defrost Team of INRIA Lille - Nord Europe.

**Topic of the proposal:**

Networked systems are prevalent in many research areas, for example vehicle platoons, synthetic biological networks, power grids or water distribution networks. It appears that the topology of the network and its associated connectivity play an important role in determining the dynamical behaviour of the networked system. Thus, due to its importance to solve monitoring and cooperative control issues, the problem of topological identification of network systems has been extensively studied for several years.

The main goal of this research is to investigate the topology identification problem for networks of dynamical complex systems, which are modelled by nonlinear ordinary differential equations with or without delays. The topology connections will be mainly considered as unknown parameters. Therefore, the topology identification will be considered as a possible way to identify both states and unknown parameters, simultaneously, of the systems involved in the network. A set of identifiable conditions will have to be developed via constructive algorithms using, for instance, differential geometry tools. Then, observers need to be designed if partial or full estimation is possible. Specifically, fast and robust estimation will be required to enhance system performance. Thus, higher order sliding mode and impulsive observers, providing for finite time convergence, need to be further studied.

Applicants must have, or expect to achieve a Master’s degree or the equivalent from an internationally recognised institution, in Engineering, Applied Mathematics, or a related subject, with strong theoretical skills and interest in Control Engineering / Automatic Control, and more particularly in observation of nonlinear systems. A strong background or/and experience in nonlinear time delay systems and sliding mode control theory is desirable. The applicant should have an English level of B2 or higher at the start of the PhD.

Interested individuals should send their detailed curriculum vitae, a cover letter with
previous academic performance and motivation, and two references to Dr Thierry FLOQUET (thierry.floquet@ec-lille.fr) and Dr Gang ZHENG (gang.zheng@inria.fr).

**Application closing date** : 20 April 2020.