

## Control of Emerging Complex Systems and Networks in 5G

Advances in communication, embedded computing, sensor and actuator technologies, are leading to a new generation of systems and networks. Examples of these systems are tele-surgery, autonomous road/ground, underwater and unmanned aerial vehicles, fleets of simple collaborative mobile autonomous/robotic systems, automated irrigation networks, automated transportation systems, smart power grids, etc.

The main barrier to developing these emerging complex systems and networks is the lack of co-design frameworks, which allow integration of control, communication and computation in a single unified framework. For these systems, we need to find novel integrated frameworks that allow real time communication of data, and compensation of communication and computation imperfections and limitations in control loops. A logical approach to addressing the above problem is to first consider less complicated scenarios (e.g., control/communication co-design, control/computation co-design, etc.) and then extension of these integrated frameworks to more complicated frameworks (e.g., control/communication/ computation co-design).

In this workshop, we first introduce a few emerging complex systems and networks. Then, we discuss the major issues on the design and development of these systems. After that, we describe some of the new integrated co-design frameworks developed for tele-operation of autonomous vehicles, coordination of fleets of autonomous under water vehicles and automated irrigation networks; and we show that using these integrated co-design frameworks the desired performance is achieved; while using the available classical design methodologies, the performance of these systems and networks is very poor.