Project title: **Control of Spatially Distributed Dynamical Systems**

Summary

Following impressive developments in communication and information technologies, but also in sensor and actuator technologies, a whole set of novel products and systems has emerged, which only recently seemed unfeasible. Examples of such systems include the so-called smart structures composed of a large number of sensors and actuators mounted on constructive elements (beams/plates) with the goal to damp undesired vibrations or to control flow of fluids; adaptive optics with large amount of optical elements; smart electrical power systems; highways with automated cars driving in platoons. Common characteristic of all of the above mentioned systems is that they are composed of a large number of spatially distributed dynamical subsystems which operate under constant mutual interactions through some physical interconnections (network) and/or communication links (network). Today, it is widely acknowledged that the key challenge in development of such dynamical networks is synthesis of algorithms for their control. The main goal of this project is development of some of the key elements in fundamental theory of control for spatially distributed systems, together with constructive controller synthesis algorithms suitable for application in real-life problems. The research focus will be on distributed control solutions in which each dynamical system in the network is controlled by its local controller and each local controller communicates and coordinates its actions with a (usually small) set of directly neighboring controllers. Our approach will be based on innovative elements from the theory of dissipative systems, while both spatially invariant networks and generic dynamical networks with arbitrary interconnection graph will be considered. The developed control algorithms will be verified in laboratory experiments on groups of mobile robots and on a distributed vibration control platform.

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