

Prof. Dr.-Ing. Dr. h.c. G. Fettweis
Vodafone Chair
01062 Dresden, Germany
Tel.: +49 351 463 41000
Fax: +49 351 463 41099
www.vodafone-chair.com

Vodafone Chair contact:

Dipl.-Ing. Peng Huang

Funded by:



Project Partners:



Associated Partners:



Motivation:

The project eNC² is advocating for joint design of communication and control in cyber physical systems exploiting adaptive networking concepts to enable global cyber physical systems. The goal of the project is to carry out multi-disciplinary and collaborative research to advance the fundamental theory for future cyber physical systems (CPSs) combining control and communication (C&C) system not by agnostic coupling but exploring the inter-dependency between C&C system. Currently, communication networks integrate disruptive novel techniques such as software defined networks (SDN) and network function virtualization (NFV) to deal with the new challenges such as i.) latency, ii.) resilience, and iii.) highly dynamic network conditions, which allow the control systems to address cyber physical systems on a global scale. From the control perspective, we have to address the integration of sensor fusion - decision making - learning (SDL) into the conventional observer-controller loop for individual cyber physical systems attached to the network, and study new mathematical models for an optimization approach to systematically derive a joint C&C structure.

Objective:

- Joint design of communication and control in cyber physical systems exploiting adaptive networking concepts to enable global cyber physical systems
- Study of combining the control and the communication system not by agnostic coupling but exploring their inter-dependency

Approach:

In a first phase, the project aims at the analysis of the flying parameter estimation performance of Kalman filters in sensor fusion application for distributed unmanned aerial vehicles. Targeting the advanced C&C system, the sensor block shall be generalized to allow sensor fusion for non-stationary inputs arriving randomly in time and with time-varying reliability. Further research considers modeling the task of hierarchical decision making in a feedback system as a mathematical optimization problem based on a suitable performance criterion and deriving the structure in a systematical way. Finally, we plan the implementation of a fully integrated testbed that allows realistic experiments and evaluation of the different approaches achieved throughout the project.

Vodafone Chair Contribution:

The Vodafone Chair for Mobile Communications Systems concentrates on a variety of different aspects which include:

- Multi-sensor fusion using Extended Kalman Filter for inertial navigation systems
- Enhanced control by learning & decision-making
- Joint control of unmanned aerial vehicles over communication networks
- Implementation of algorithms and test based on actual measurement data

