

Forschungspraxis, Master's Thesis

Impact of Bursty Losses on the Transient QoC of NCS

Thanks to the ease of deployment and low cost, Wireless Sensor Networks (WSN) is a good candidate technology for many applications.

In the context of industrial applications, WSN provides the necessary communication infrastructure for sensors and actuators to wirelessly operate in closed-loop control systems called Networked Control Systems (NCSs).

WSN devices, however, are subject to packet loss due to the low-power communication technology and external disturbances.

This effect severely degrades the quality of control and can lead to the instability of the system under control [1].

In this work:

- An industrial wireless sensor network will be deployed - using Zolertia Re-Motes and the Contiki-NG firmware.
- A measurement-based model of the WSN channel quality will be obtained.
- A simulation of an LTI NCS will be implemented [3].
- The transient QoC of NCS will be evaluated following the NCS benchmarking methodology in [2].

[1]: Zhang, Lixian, Huijun Gao, and Okyay Kaynak. "Network-induced constraints in networked control systems—A survey." IEEE transactions on industrial informatics 9.1 (2012): 403-416.

[2]: Zoppi, S., Ayan, O., Molinari, F., Music, Z., Gallenmüller, S., Carle, G., & Kellerer, W. "NCSbenchReproducible Benchmarking Platform for Networked Control Systems."

[3]: Music, Z., Molinari, F., Gallenmüller, S., Ayan, O., Zoppi, S., Kellerer, W., ... & Raisch, J. (2018). Design Of a Networked Controller For a Two-Wheeled Inverted Pendulum Robot. arXiv preprint arXiv:1812.03071

Prerequisites

This work will consist of a significant amount of programming for embedded devices, and for a large part also of processing the measurement data.

Requirements:

- Strong C and Python programming skills.
- Good knowledge of wireless systems and protocols (WSN).
- Basic knowledge of LTI control systems.
- Experience with python/Matlab data processing tools is beneficial.
- Experience with embedded systems is beneficial but not required.

Advisors

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