

Intelligent Control Strategies for Nonlinear Systems

Summary

The aim of the PhD project is to develop novel control methods for nonlinear dynamical systems. The developed methods will be based on combining the flatness-based feedforward control with the ideas from event-based control approach. There are different theoretical and practical aspects that the PhD candidate can study within the project.

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| Research field: | Information and communication technology |
| Supervisors: | Prof. Dr. Juri Belikov Dr. Arvo Kaldmäe |
| Availability: | This position is available. |
| Offered by: | School of Information Technologies Department of Software Science |
| Application deadline: | Applications are accepted between June 01, 2022 00:00 and June 30, 2022 23:59 (Europe/Zurich) |

Description

The proposed PhD project deals with developing novel intelligent control strategies for nonlinear systems with emphasis on energy and power systems domain. The project follows the idea that modern control methods should be applicable to complex systems, be responsive to disturbances as well as they should be resource aware. For the latter, the project focuses mainly on the concept of event-based control. The major part of the project will be devoted to study of disturbance observers and disturbance observer-based control to estimate and compensate disturbances affecting the system dynamics. Such generality allows the potential PhD student to work in many different theoretical and practical problem areas such as stability of dynamical systems, decision-making, observer design, controller design with a primary focus on energy systems.

Some of the possible research questions are as follows:

- What are the best methods for designing disturbance observers?
- How to choose the best time for event generation?
- How can we use event-based mechanism to enhance integration of renewable energy sources?

The PhD candidate is expected to contribute to theoretical aspects as well as to practical aspects such as running simulations, planning experiments, and supervision of students. More detailed tasks can be agreed based on the knowledge and experience of the potential PhD candidate.

It is assumed that the PhD candidate is familiar with the basic definitions and concepts used in nonlinear control theory and has some basic knowledge from power system domain. Previous knowledge on event-based control or disturbance observers is seen as an advantage as they are one of the main concepts used in the project.

Supervisor: Dr. Arvo Kaldmäe

Co-supervisor: Prof. Dr. Juri Belikov

Applicants should fulfil the following requirements:

- Master's degree in mathematical control theory, systems and control, applied mathematics or related fields
- Strong background in nonlinear control theory
- Basic knowledge from power system domain
- Knowledge of Matlab/Simulink
- Excellent communication skills in oral and written English language



- Previous research experience



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