Advanced Control Methods for Adaptive Mechanical Systems

Module-No./Abbreviation	Credits	Workload	Term	Frequency	Duration
CE-WP13/ ACMAMS	6 CP	180 h	3rd Sem.	Winter term	1 Semester

Courses	Contact hours	Self-Study	Group Size:
Advanced Control Theory, Structural Control	4 SWS (60 h)	120 h	No Restrictions

Prerequisites
Adaptronics (CE-WP03), fundamentals of control theory and structural control.

Learning goals / Competences
Extended knowledge in adaptive mechanical systems, advanced control methods and their application for the active control of structures.
After successfully completing the module, the students

- have advanced knowledge in control systems design,
- are able to design full order observer of the states in a state space model,
- have basic knowledge in observation using Kalman filter,
- have basic knowledge in the system identification of state-space models,
- have knowledge in experimental modal analysis,
- are able to independently design a velocity feedback vibration suppression for basic mechanical structures.

Content
Advanced methods for the control of adaptive mechanical systems are introduced in the course. This involves the recapitulation of the fundamentals of active structural control and an extension to advanced control. Observer design is introduced as a tool for the estimation of system states. In addition to numerical modelling using the finite element approach, system identification is explained as an experimental approach. Theoretical backgrounds of the experimental structural modal analysis are introduced along with the terms and definitions used in signal processing. Experimental modal analysis is explained using the Fast Fourier Transform. Advanced closed loop control methods involving optimal discrete-time control, introduction of additional dynamic approaches for the compensation of periodic excitations and basic adaptive control algorithms are explained and pragmatically applied for solving problems of vibration suppression in civil and mechanical engineering.

Teaching methods / Language
Lecture (2h / week), exercises and practical work (2h / week) / English

Mode of assessment
Written examination (120 min, 100%) / Seminar paper

Requirement for the award of credit points
Passed seminar paper and passed final module examination

Module applicability
MSc. Computational Engineering

Weight of the mark for the final score
6 %

Module coordinator and lecturer(s)
Prof. Dr.-Ing. T. Nestorović, Assistants

Further information