## 6.3 Modul Control Systems II

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| Modulbezeichnung | **Control Systems II** |
| Kürzel für Stundenplan | **CS2** |
| Semester | 6 |
| Modulverantwortliche(r) | Prof. Dr. Jörg Bayerlein |
| Dozent(in) | Prof. Dr. Jörg Bayerlein |
| Sprache | Englisch |
| Zuordnung zum Curriculum | KIM – ISE (Pflichtmodul) und Wahlpflicht für KIM / ESA |
| Lehrform / SWS | 3 V + 1 Pr, with integrated exercises, 80 students (V), 12 (Pr) per group |
| Arbeitsaufwand | 52 h presence (36 h lecture, 16 h Lab)<br>60 h preparation and evaluation afterwards of class<br>38 h preparation and report Lab |
| Kreditpunkte | 5 |
| Voraussetzungen | Knowledge of "Signale und Systeme", "Messtechnik und Sensorik", Analog Electronics II", "Control Systems I" |
| Lernziele / Kompetenzen | The students should learn to convert a classical PIDT1 into a digital algorithm with rectangular approach. Introduction of Z-Transform Design of controllers and filters into digital algorithms. PC-based identification algorithms like step response with Least square optimization, Least square offline and online method. Introduction into special controllers |
| Inhalt | **Basics of digital controller**<br>Conversion of PID into recursive algorithm with rectangular approach. Choice of sampling time. Analogue design including side effects hold block, delay and step depth of a digital PID. Program example.<br>**Z-transform methods**<br>Introduction of Z-transform. Methods to design filters / controllers via conversion of F(p) into F(z). PIDT1 with free step depth. Dead beat control algorithm<br>**Identification methods**<br>Simple parameter extraction method. Step response identification using LS-method. Two-point controller 2PT1-method. LS-methods offline and online.<br>**Introduction into special controllers**<br>Introduction and some simple examples of some special controllers like Dead beat, Fuzzy, PFC. |

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| | **Lab experiments:**<br>• Design of digital PIDT1- controller with a position control system. nonlinear effects, comparison of P, PI, PIDT1, PDT1, DeadBeat, cascaded controller, Anti- wind- Up mechanism<br>• Test of several digital adaptive and non adaptive controllers using simulated processes and speed control system<br>• Design and test of an inverted pendulum programmed on a PC |
| Literatur | • Bayerlein,J.: *Workbook control systems*, available press FHL<br>• Phillips, C. L.: *Feedback Control Systems*, Prentice Hall newest version<br>• Ogata, K.: *Modern Control Engineering*, Prentice Hall, newest version<br>• Saadat; Hadi: *Computational Aids in Control Systems Using MATLAB*, McGrawHill, newest version |
| Studien-/Prüfungsleistungen | Pr (Studienleistung), V (Prüfungsleistung): Klausur (60 Minuten) |