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| <b>Module Name</b>                                  | <b>Electromechanical and Microelectromechanical Systems</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Module Number</b>                                | Eul-ET-E-EMS, Eul-IST-E-EMS, Eul-MT-E-EMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Responsible Lecturer</b>                         | Prof. Dr.-Ing. habil. Uwe Marschner<br>uwe.marschner@tu-dresden.de                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Qualification Objectives</b>                     | Upon completion of the module, students possess fundamental methodological and practical knowledge for the effective design and illustrative analysis of the dynamic behavior of electromechanical, microelectromechanical (MEMS), and electromagnetic systems, as well as for the functionality and modeling of reversible electromechanical transducers in sensors and actuators. They are familiar with parameter determination using finite element methods and master the methodology of combining these methods with virtual interface components. Students are capable of applying clear and illustrative analysis methods for electrical networks, developing a better physical understanding, designing physically diverse subsystems in an integrated manner, and simulating them using available design software such as SPICE.                                     |
| <b>Contents</b>                                     | The module covers the description of coupled multiphysical subsystems in the form of a unified circuit-based representation and their behavioral simulation. Simple mechanical, magnetic, fluidic (acoustic), electrical, and coupled systems, including their interactions, are analyzed. Complex problems related to the design-oriented optimization of the dynamic behavior of electromechanical systems are solved by combining network simulation of electromechanical systems with finite element modeling. The practical component includes finite element and LTSPICE simulation tools.                                                                                                                                                                                                                                                                               |
| <b>Teaching and Learning Forms</b>                  | 2 hours per week of lectures, 2 hours per week of exercises, 1 hour per week of practical lab courses, and self-study.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Prerequisites for Participation</b>              | The competencies to be acquired in the modules Basics of Electrical Engineering, as well as in the diploma programs Mechatronics and Electrical Engineering in the modules Physics and Materials, and in the diploma program Information Systems Engineering in the module Microelectronic Technologies and Components, are required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Usability</b>                                    | The module is an elective module in the elective area "Competence Deepening" according to § 6 Paragraph 3 SO and § 33 Paragraph 4 PO of the main study program in the field of Microelectronics in the diploma program Electrical Engineering. Furthermore, it is an elective module in the elective area "Competence Deepening" according to § 6 Paragraph 3 SO and § 33 Paragraph 3 PO of the main study program in the field of Microelectronics, Electronic Circuits, and Systems in the diploma program Information Systems Engineering. Additionally, it is an elective module in the elective area "Methods and Applications" according to § 6 Paragraph 3 SO and § 33 Paragraph 3 PO of the main study program in the diploma program Mechatronics. It creates the prerequisites for the modules that list this module in the field "Prerequisites for Participation." |
| <b>Prerequisites for the Award of Credit Points</b> | Credit points are awarded when the module examination is passed. The module examination consists of a portfolio with a workload of 8 hours and a written exam lasting 120 minutes. For up to 10 registered students, the written exam is replaced by a non-public oral group examination lasting 20 minutes. If applicable, this will be announced to the registered students at the end of the registration period in the usual manner.                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Credit Points and Grades</b>                     | 7 credit points can be earned through the module. The module grade is determined by the weighted average of the examination performances. Here, the written exam or oral examination is weighted threefold, and the portfolio is weighted singly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Frequency of the Module</b>                      | The module is offered every summer semester.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Workload</b>                                     | The total workload is 210 hours.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

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| <b>Duration of the Module</b> | The module lasts one semester. |
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