

Module Name	System Dynamics of Mechanical Structures
Module Number	Eul-MT-E-MSD
Responsible Lecturer	Prof. Dr.-Ing. Michael Beitelschmidt michael.beitelschmidt@tu-dresden.de
Qualification Objectives	After successfully completing the module, students are able to apply engineering calculation methods for modeling and interpreting dynamic effects in mechanical structures. Specifically, they master the system-theoretical fundamentals of mechanical systems and their modeling. They are familiar with specific problems of mechanical structures and their characteristics. Students have an overview of the theory of linear vibrations with finite degrees of freedom, the treatment of free and constrained torsional vibration systems in drive dynamics, and bending vibrations considering gyroscopic effects. They are proficient in general methods of numerical and experimental modal analysis, as well as specific procedures for estimating natural frequencies and vibration modes. Additionally, they have practical skills in applying modern measurement techniques and methods to capture and interpret the dynamic behavior of mechanical structures.
Contents	The module includes methods for the analytical and experimental investigation of mechanical structures, as well as practical applications of system-theoretical fundamentals and modeling of mechanical structures. Topics include the dynamics of constrained mechanisms, such as equations of motion, loads due to mass forces, vibrations, and mass balancing. Further topics cover the dynamics of systems with one degree of freedom and multiple degrees of freedom, such as equations of motion, free and forced vibrations under various loads. The module also includes various practical calculation methods, such as numerical and experimental modal analysis, frequency response analysis, transient analysis, and the dynamics of elastic rotors focusing on Laval rotors, equations of motion, critical bending speeds, gyroscopic effects, as well as the dynamics of continua focusing on torsional vibrations of shafts and bending vibrations of beams.
Teaching and Learning Forms	2 hours per week of lectures, 1 hour per week of exercises, 1 hour per week of practical sessions, and self-study.
Prerequisites for Participation	The competencies to be acquired in the modules Introduction to Analysis and Algebra, Multidimensional Differential and Integral Calculus, Partial Differential Equations and Probability Theory, as well as Engineering Mechanics and Fundamentals of Kinematics and Kinetics, are required.
Usability	The module is one of four elective modules in the elective area "Mechatronics Special Knowledge" in the main study program of the diploma program Mechatronics, of which three must be selected. It creates the prerequisites for the modules that list this module under "Prerequisites for Participation."
Prerequisites for the Award of Credit Points	Credit points are awarded when the module examination is passed. The module examination consists of a written exam lasting 120 minutes and a

	portfolio with a workload of 12 hours. The written exam is mandatory for passing.
Credit Points and Grades	5 credit points can be earned through the module. The module grade is determined from the weighted average of the grades of the examination components. The written exam is weighted fourfold, and the portfolio is weighted singly.
Frequency of the Module	The module is offered every summer semester.
Workload	The total workload is 150 hours.
Duration of the Module	The module lasts one semester.