Modern Mechanical Design Theory and Method

This course is open to graduate students for learning the modern design theory such as finite element method, reliable design and soft packages for mechanical engineers. With the rapid development progress in the design theory, design tool and manufacture technology, it is required to use the new scientific and technological knowledge to replace the old contents in the design courses. Based on the current art of the design methodology, the course of "The Modern Design Theory" is designed with the following chapters as listed in the next section.

Advanced manufacturing technology and system

Teach the comprehensive application technology including mechanical engineering, materials, information and modern management technology etc. Based on the the latest development of discipline and engineering application, introduce the basic theory and method from product development and design, manufacturing and management to the whole process of manufacturing. The revised course may include advanced manufacturing basics theory, method and application technology. The application technology will be the important direction basic method and its application content including the intelligent manufacturing (Industrial 4) foundation, micro-nano manufacturing principle instance, the special machining manufacturing principle and examples, medical instrument design and manufacturing instance parts, etc.

Molecular Dynamics Simulations

The basic principles, algorithms, and implementation of molecular simulation will be introduced. After this course, students can use molecular dynamics simulations in their own study.

Design of Experiments and Uncertainty Analysis

Concepts and principles of experimental design and uncertainty analysis will be introduced. Random and systematic uncertainty analyses of measured variables, propagation of uncertainties are the key points of this course. After this course, students will be able to design their own experiments based on the principles of uncertainty analysis.

Signal Processing and Analysis of Mechanical Systems

The course of Signal Processing and Analysis of Mechanical Systems is to introduce the basic concepts，principles，methodology and engineering applications of modern signal processing for the graduate students in mechanical engineering. The main contents include the characteristics of stationary and non-stationary stochastic signals, the essence of signal modeling and mathematical transformation, and the physical and engineering background of signal orthogonal decomposition. The teaching goals are to enable students to master the basic methods of modern signal processing and analysis, including the concepts of stochastic process, modeling and identification, time domain analysis, frequency domain analysis, time-frequency domain analysis and blind source separation of stochastic signals. Moreover, the students should be able to apply the above methods to solve the engineering practical problems such as the dynamic analysis, condition monitoring, fault diagnosis, equipment management and maintenance of mechanical and electrical equipment.

Finite Element Procedures

Finite element analysis, using mathematical approximation method of real physical systems (geometry and load conditions) simulation. Also the use of simple and interacting elements, namely unit, you can use a limited number of unknown quantities to approximate the infinite unknown amount of the real system.

Finite element analysis is relatively simple problem instead of solving complex problems before. It subdomain as by a number called finite element interconnecting small child domains, each unit is assumed that a suitable (relatively simple) approximate solution for solving this field then derive the general condition (such as structural the equilibrium conditions), resulting **in** solution of the problem. The solution is not the exact solution, but an approximate solution, because the real problem is replaced by a relatively simple problem. Since most of the practical problems difficult to get exact solutions, and finite element calculation not only high accuracy, and can adapt to a variety of complex shapes, thus becoming an effective means of engineering analysis.

Advanced Manufacturing Technology (seminar)

Three dimensional printing and the related advanced manufacturing technologies are important manufacturing methods which make use of the interaction of photons, ions, electrons

and materials. They are integrated high and new technologies combined optics, ionics, electronics, mechanics, materials science and computers.

Through learning of this course, students can get a systematic knowledge and understanding of principles, processes, structures, performances and applications of manufacturing technologies which use photons, ions and electrons as a heat source and power supply.

Several seminars are arranged to focus on the typical applications of advanced manufacturing technologies, such as aerospace equipment, ship marine engineering equipment and high technology, advanced rail transportation equipment and the application of energy saving and new energy vehicles.

Modeling and Simulation of Mechatronic System

Postgraduate students in mechanical engineering will finally deal with the whole machine and production process, they are required to master the relevant theory and experimental analysis methods. Based on the concept of system, this course discusses how to carry out the modeling, simulation and experimental verification of mechatronic systems, taking vibratory feeders as a case study. This course will lay stress on the practical operation and require the students to experience the whole process from the modeling, simulation to experimental verification, which is supposed to deepen their understanding of mechatronic systems and will lay a solid foundation for future study and solution of the practical problems in mechatronic systems.

Microcomputer Interface and Control Technology of Mechatronic System

暂无英文

本课程是机械电子方向的一门专业选修课，在简要讲授单片微机原理后，通过介绍微机系统配置与接口技术（重点介绍微机测控前向、后向通道和抗干扰设计），使学生掌握微机应用和接口通道设计等方面的软硬件知识；通过温度、压力为代表的过程物理量测控两类实际工程案例的研讨，培养学生综合运用所学微机、电子技术、控制等知识点，系统地分析和解决实际问题的能力，为学习后续课程、从事工程技术研究工作以及开拓新技术领域打下坚实的基础。

Theory of mechanical vibration with applications

Goals: Students should master the fundamental theories of vibration of a single -DOF system, multi-DOF system and continue system as well as the molding and solution methods for the further studies.

1. Students will have the knowledge of the three main factors in vibration system: stiffness, mass and damping, and knowing how to build the vibration equation of single -DOF system and to solve the nature frequency as well as respond in different exciting.
2. Students should know how to establish the stiffness and mass matrix of multi-DOF system, and understand the mode concept.
3. Student should familiarize the model building and equations solving of continue system: string , rods, beam and plate.

Requirement: Students who will attend this course should have the preliminary course of dynamics.

Ergonomics

By studying this course, students will master the character of physiology and psychology in information transfer and communication between people and machine, making people's manipulation during the interface process easier and more efficient. Through the introduction of Human-Machine Interface development at home and abroad recently, they will master all kinds of new design ideology and design requirement about human-machine interface in product design.

Analysis and Design of System Reliability

With the increase of the complexity in the structure and function of mechanical and electrical products, system safety, reliability, maintenance and after-sale service have becoming more serious than before. By now, life and reliability have become important indexes of products' performance. The research areas of system reliability subject cover the areas including mechanical engineering, communication, information, electrical engineering, automation, aeronautics and astronautics engineering, civil engineering, etc.

From the view of analysis and design of system design, this course will introduce the basic

concept and modeling approaches of system reliability, reliability prediction and allocation, failure analysis, reliability test, reliability design of mechanical element, reliability management, warranty, etc. The course will not only pay attention to the mainstream theories, it will also provide typical case studies, and some main reliability analysis software (e.g. Weibull++, Blocksim, et al) will also be introduced, thus the theory and application methods will be integrated.

Kinematics of Mechanisms and Robots

Kinematics is the study of motion. This is a course about the kinematic analysis and synthesis of mechanical systems. The goal is to arrive at an intuitive and theoretically sound approach to describing and synthesizing the motion of a variety of mechanical systems including robots. The course is comprised of four significant parts: sketching, spatial path, robotics, and design. Sketching seeks to develop intuition about how things move based on geometry alone. From that understanding, design rules may be generated for synthesizing a mechanism. Spatial math presents coordinate transformations, the formalism typically used to describe spatial motion. This study results in an improved grasp of the operational aspects of linear algebra. Robotics takes a close look at applying coordinate transformations to spatial systems. Relationships are developed between the robot's joint positions and speeds and the resulting gripper motion. Finally, design applies the geometric notions discovered in sketching with the tools developed in spatial math to synthesize planar mechanisms.

Engineering Fluid Mechanics

The course of Fluid Mechanics is targeted for graduate students in mechanical engineering to introduce them the basic concepts, principles, methodologies and engineering applications of fluid mechanics. The main contents include the fundamental aspects of fluid motion, 1D, 2D, and 3D fluid flow, computational fluid mechanics, and measurement techniques. The teaching goals are to enable students to master the computation of pressure distribution of static fluid, the Bernoulli equation, the Navier-Stokes equation, viscous flow in pipes, and the development of boundary layer of flow past objects. Moreover, the students should be able to apply the above methods to solve the engineering practical problems such as measurements of fluid viscosity, density, and surface tension, modeling and measurement of flow velocity, energy conversion.