Power Electronics & Power Transmission

The English-taught Master of Engineering (M.E.) in Power Electronics & Power Transmission program extensively enrolls and cultivates worldwide master's degree students under the primary discipline Automation. It also relates to the disciplines of Electrical Engineering, Communication Technology, and Computer Technology.

The research fields cover intelligent control and intelligent automation, intelligent information sensing and communication engineering, intelligent decision support system, pattern recognition, electric drive, modeling and control of productive process, industrial network, and system integration with database and data warehouse.

The program has endeavored in cultivating high-level international talents with comprehensive capability in automation and relevant fields in electrical engineering.

Study Duration, Credits and Degree Awarding

In line with the Chinese university system, Masters degrees in Donghua University last for two years and a half and the school starts from fall. A typical workload of the first year full-time study is a set of courses worth a total of 34 credits, composed of 22 compulsory and 12 elective credits. From the second year, students will undertake a research project and write a dissertation.

Students who are academically qualified, successfully fulfill 34 credits within designated years, accomplish the dissertation, pass the thesis defense and finally be approved by Donghua University Academic Degree Evaluation Committee will be awarded Master Degree in Engineering of Donghua University.

Curriculum

Compulsory Courses (22 credits)

- ✓ Modern Mathematical Methods (3 credits)
- ✓ Modern Control Theory (3 credits)
- ✓ Pattern Recognition: Theory and Technology (3 credits)
- ✓ Intelligent Systems and Control (3 credits)
- ✓ Introduction to China (2 credits)
- ✓ Chinese Language (8 credits)

Elective Courses (at least 4 from the courses below)

- ✓ Embedded Systems: Theory and Application(3 credits)
- ✓ Information Security of Networks (3 credits)

- ✓ Data Mining (3 credits)
- ✓ Internet of Things (3 credits)
- ✓ Modern Signal Processing(3 credits)
- ✓ Image Communication and Information Processing (3 credits)

Course Description:

✓ **Modern Mathematical Methods:**

Introduction to Modern Mathematics presents a collection of expository introductions to, and surveys of, several active and important topics in mathematics. This course focuses on the general theoretical framework and basic method of modeling and simulation, and focuses on several classical methods and modern methods based on system identification and modeling methods. Through the analysis of typical cases, the idea and method of system simulation are expounded. It is helpful to understand the basic theory of system simulation, the representative of the domestic and international research, and to lay the foundation for the study of the students in this direction. The objective is to make the students have a comprehensive understanding of modern mathematics, which is a specific and clear understanding of the application of modern mathematics method in solving scientific problems.

✓ **Modern Control Theory:**

This course includes two parts: linear systems and nonlinear systems. In part I, four chapters are included as follows. Chapter 1: State-Space Descriptions. This chapter will introduce several fundamental notions and definitions. An introduction to the major themes of this chapter is provided by considering a particular way of stabilizing a given system. Chapter 2: Controllability and Observability. In this section we shall explore further some of the important properties of the concepts of the controllability and observability. Also we shall bring out their significance for the important problem of deciding when a given realization is minimal, i.e., realized with the smallest possible number of integrators. Chapter 3: Motion Analysis. In this section，we shall develop the properties of the state-transition matrix in more detail and describe its use in representing the solution of the state equations. Chapter 4: Time Domain Synthesis. In this section, we shall show how to calculate the gain vector for the appropriate state feedback in several different ways. We shall see that using a combination of state-space and transfer function methods can be highly effective. In part II, this course introduces the nonlinear systems, mainly including the Lyapunov stability theorems, LaSalle's theorem, stability of perturbed systems with vanishing and non-vanishing perturbations.

✓ **Pattern Recognition: Theory and Technology:**

With the ever increasing amounts of data in electronic form, the need for automated methods for data analysis continues to grow. The goal of pattern recognition is to develop methods that can automatically detect knowledge hidden in data, and then to use the

uncovered patterns to predict future data or other outcomes of interest. This course provides a detailed introduction to pattern recognition theory and techniques, and includes worked examples drawn from application domains such as molecular biology, text processing, computer vision, and robotics. The aim of this course is to provide descriptions of the most useful pattern processing techniques including many of the recent advances in nonparametric approaches to discrimination and Bayesian computational methods developed in the statistics literature and elsewhere. Discussions provided on the motivations and theory behind these techniques will enable the practitioner to gain maximum benefit from their implementations within many of the popular software packages.

- ✓ **Intelligent Systems and Control:**

This course provides recent fruits, ideas and dynamic information in the field of intelligent systems and control. The main topics include: Representation, Search and Reasoning of Knowledge; Applications of Genetic Algorithms; Immune Computation and Natural Computation; Neural Network and Its Applications; Clonal Selection Algorithm and aiNET; Machine Learning and Learning Control; Fuzzy Control and Its Applications.

- ✓ **Embedded systems: theory and application:**

Embedded system is a widespread-used computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. The learning objectives of this course focus on how to design an integrated embedded system based on Programmable System On Chip 5 Low Power (PSOC5LP) with ARM Cortex-M3 core from Cypress, and include: foundation of embedded systems, introduction of ARM Cortex-M3 and PSOC5LP, Proteus embedded systems simulation software, PSOC Creator Integrated Development Environment (IDE), programmable analog subsystem of PSOC5LP, programmable digital subsystem of PSOC5LP, c/os III Real Time Operation System (RTOS), and design of integrated embedded system.

- ✓ **Data Mining:**

Data mining refers to a set of techniques that have been designed to efficiently find interesting pieces of information or knowledge in large amounts of data. Interest in the field is motivated by the growth of computerized data collections which are routinely kept by many organizations and commercial enterprises, and by the high potential value of patterns discovered in those collections. This course is to introduce basic concepts and techniques of data mining, and present the techniques most commonly employed in the analysis of large volumes of data, in the extraction of knowledge from this data, and in making decisions based on the knowledge acquired. In this course we explore how this interdisciplinary field brings together techniques from databases, statistics, machine learning, and information retrieval. We will discuss the main data mining techniques currently used, including data cleaning, clustering, classification, regression, forecasting, association rules mining, and recent techniques for web mining. After finishing this course, students will be able to understand typical data mining process and the different mining algorithm available by

popular commercial data mining software; and know the different types of problems (tasks) that can be addressed through data mining.

- ✓ **Internet of Things:**

The Internet of Things (IoT) refers to the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data. On the basis of better usage of resources, better control over infrastructure, assets or service, IoT has considerably improved user's decision. As one of the most significant and innovative technology, IoT has been applied successfully to build smart cities, smart environment, smart agriculture as well as major improvements in industrial application, security & emergency operation, health monitoring and home automation. The main objective of the course is to provide a comprehensive understanding of the IoT into the world of "smart" solutions, including basic skills to understand the architectural design and fundamental concepts of IoT. Topics mainly include an overview of the current researches in the IoT, connected product concepts, development platforms, user experience, challenges and future directions. This course enables students to understand what IoT technologies are and what is required in certain scenarios. After the course the students should have some knowledge of the architectures, models and applications, and understand the basic principles behind them.

- ✓ **Modern signal processing:**

The goals of this course are to enable you to apply digital signal processing concepts to your own field of interest, to make it possible for you to read the technical literature on digital signal processing, and to provide the background for the study of more advanced topics and applications. The topics of this course include: 1) Review of Linear Continuous-Time Signal Processing; 2) Introduction to Real-Time Computation; 3) Sampling and Reconstruction; 4) Discrete-Time Signal Processing; 5) Discrete Spectral Analysis; 6) Real-Time Simulation Methods Using Difference Equations; 7) Filter Design -Continuous and Discrete; 8) Statistical Signal Processing.

- ✓ **Image Communication and Information Processing:**

This course introduces the basic concepts, basic principles and problem-solving methods for image communication and information processing. So that students master the basic image processing methods, understand the various applications related to information processing technology. The main contents of this course include the procedure of image processing and image communication, fundamentals of image communication, point operations, local operations, global operations, region oriented segmentation, contour-oriented segmentation, Hough transform, morphological image processing, texture analysis, pattern recognition and image sequence analysis. Training students to master the ability to solve practical problems related to image processing under VC ++ environment.