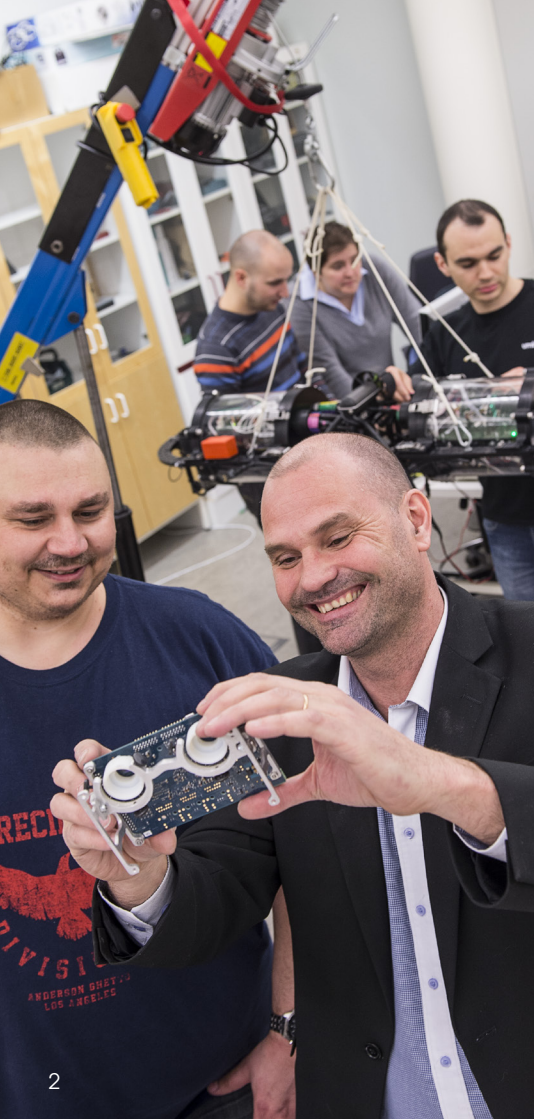
FutureE

ADVANCED LEVEL WEB BASED COURSES
– IN COOPERATION WITH INDUSTRY

MÄLARDALEN UNIVERSITY
SWEDEN



EMBEDDED SYSTEMS

Embedded Systems, ES, conducts research in cooperation with industry, with the mission to provide research excellence that enables industry to take advantage of the opportunity provided by software in products and production systems.

Embedded Systems is the most research-intensive research profile at Mälardalen University and a national leader in embedded systems research. Research at ES has a dominating focus on embedded software. Our mission is to provide research excellence that enables industry to take advantage of the opportunity provided by software in products and production systems.

We have world leading competence in embedded software development and real-time systems modelling and analysis. We offer extensive experience of Embedded Systems international projects, proven track record in industrial cooperation and commercialization of research and a professional research organization.

Internationally, Embedded Systems has extensive cooperation and is known for its research as well as its strong industrial links. Industrial partners include major companies, such as ABB, Bombardier, Ericsson, Scania and Volvo, as well as many smaller businesses, including several spin-off companies.

Embedded Systems provides a stimulating international research environment, characterized by its cooperative atmosphere, openness, and team spirit – a great environment for a researcher to grow in; with a mix of established and young researchers, several of which are employed or funded by industry.

MORE INFORMATION
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ADVANCED COURSES IN EMBEDDED SYSTEMS AT MÄLARDALEN UNIVERSITY

ADVANCED TEST GENERATION
2,5 CREDITS

Course leader: Eduard Paul Enoiu

This course provides an understanding of automating software testing using program analysis with the goal of intelligently and algorithmically creating tests. The course covers search-based test generation, combinatorial and random testing while highlighting the challenges associated with the use of automatic test generation.

SYSTEMS-OF-SYSTEMS ENGINEERING
2.5 CREDITS

Course leader: Jakob Axelsson

The course gives an introduction to Systems-of-Systems (SoS). An SoS consists of independent systems that collaborate to reach a common goal. This becomes common due to digitalization and automation, where systems are rich in data of value to others.

INTRODUCTION TO IOT INFRASTRUCTURES
2.5 CREDITS

Course leader: Mohammad Ashjaei

The purpose is to provide knowledge and skills needed to build Internet of Things systems, going beyond traditional Embedded Systems courses; introducing a conceptual framework that embraces automation, communication and new forms of computing like Cloud and Fog/Edge.

PREDICTIVE BIG DATA ANALYTICS
2.5 CREDITS

Course leader: Shahina Begum

The course will give insights in fundamental concepts of machine learning and actionable forecasting using predictive analytics. It will cover the key concepts to extract useful information and knowledge from big data sets for analytical modeling.

DEEP LEARNING FOR INDUSTRIAL IMAGING
2.5 CREDITS

Course leader: Mobyen Uddin Ahmed

This course provides fundamentals of deep learning. The student will learn to design intelligent systems using deep learning e.g., convolutional neural network for Industrial Imaging.

STATISTICAL ANALYSIS IN INDUSTRIAL SYSTEMS
2.5 CREDITS

Course leader: Ivan Tomasic

Modern industrial plants and environments measure and store all relevant production variables. In addition to observation, the data can be obtained also by experimentation. The course provides fundamental elements of applied statistical analysis that can be used to analyze and model the data obtained from industrial plants, as well as introduction to practical methods for applied statistical analysis.

FUTURE ENERGY

The challenges due to the energy related emissions, increased energy demand and the fragile state of the global economy calls for rethinking global energy systems. Therefore, the research within the Future Energy Center focuses on renewable energy, energy efficiency and emission mitigation, as well as smarter modelling, optimization and management.

The Future Energy Center is one of Sweden's strongest environments in process optimization targeting the process industry and the energy sector. We develop innovative solutions and tools within the areas of energy, building and environmental engineering.

The Future Energy Center has good relationships with both companies and recognized national and international centers, including several Chinese universities.

The research at Future Energy Center is focused around three areas:

- Track 1: Renewable energy
- Track 2: Energy efficiency and emissions mitigation
- Track 3: Smarter modelling/optimisation and management

MORE INFORMATION
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ADVANCED COURSES IN FUTURE ENERGY AT MÄLARDALEN UNIVERSITY

PROCESS CONTROL AND INSTRUMENTATION

2.5 CREDITS

Course leader: Ioanna Aslanidou

The course will illustrate how to design and implement a practical control system depending on the process variables, constraints, measurements, and performance requirements. Participants will apply this knowledge to real examples in a simulation environment, from controlled variables and control architecture selection to gains set up. The course will give an overview of sensors and instrumentation commonly used in energy process and power plants, including smart sensors, and their application to process control. Different control methods and strategies will be described with examples from industrial applications.The purpose is understanding the practical challenges in process control and instrumentation and familiarizing with commonly used methods. Being able to design and apply a control system for an industrial process, selecting the best architecture and optimizing the gains.

POWERPLANT AND PROCESS MONITORING AND DIAGNOSTICS

2.5 CREDITS

Course leader: Valentina Zaccaria

The course will give an overview of process monitoring and diagnostics with a focus on the power generation sector. Different fault detection methods using physics-based and data-driven models coupled with machine learning techniques will be covered. The course will address challenges currently experienced in the process industry with regards to powerplant health management. The course will allow participants to familiarize themselves with process monitoring and apply their knowledge of process performance and simulation to the development of advanced algorithms for fault diagnosis.

APPLIED MULTIVARIATE DATA ANALYSIS

2.5 CREDITS

Course leader: Monica Odlare

The course focuses on multivariate data analysis (MVDA) which is a general name for several statistical methods which analyze structure and relationship of multiple independent and dependent variables within a system. In the first part of the course, we will focus on data exploration, descriptive statistics in order to gain an overview of given data sets. Then we will employ principle component analysis (PCA) to reveal hidden structures within the data set. Moreover, we will deal with quantitative analytical techniques represented by Principal component regression (PCR), Partial least squares regression (PLS) which are relating variations in dependent variable(s) to variations of several independent variables.

ADVANCED COURSES IN FUTURE ENERGY AT MÄLARDALEN UNIVERSITY

In following part we will also discuss several qualitative analytical techniques represented by Hierarchical clustering (HCA), Soft independent modelling by class analogy (SIMCA) and Partial least squares discriminant analysis (PLS-DA) which are suitable for further explanatory analysis of the data and can be used to classify samples into groups. Course participants will further develop good understanding of proper calibration and validation principles and will be able to correctly interpret the results.

Final modules of the course (case studies) will be focused on solving real experimental and industrial problems by firstly applying MVDA for system identification of industrial process and secondly as chemometric tool to enable spectroscopic method to measure a property of interest of given feedstock/product.

APPLIED SPECTROSCOPY

2.5 CREDITS

Course leader: Jan Skvaril

The course focuses on three important spectroscopy techniques used in research and industry to analyze chemical and structural properties of feedstocks/products by interactions with electromagnetic radiation. We will specifically target Ultraviolet-Visible, Near-infrared and Infrared and Raman spectroscopies. In the first part of the course we will introduce the electromagnetic spectrum. We will also discuss underlying theories behind matter transitions affecting radiation in different spectra ranges and thus enabling spectroscopic analysis. In following part of the course, participants will learn how to operate various spectrometers including procedures of correct material sampling, preparation and spectral data acquisition. During the course participants will develop a good understanding of how to interpret complex information obtained by various spectroscopic techniques and how to extract information with help of chemometric mathematical tools. Final modules of the course (case studies) will be focused on solving real experimental and industrial problems by introducing qualitative and quantitative spectral characterization of liquid and solid feedstocks or products.

AIR QUALITY MANAGEMENT

2.5 CREDITS

Course leader: Patrik Klintenberg

The purpose of the course is to give students enhanced knowledge about all aspects related to a modern functional air quality management system. The course takes an elevated view on the subject, addressing aspects like: sources of air pollution, methods for air quality monitoring and modelling, organization of AQM, strategy and policy frameworks in Sweden and elsewhere, standards and regulations, and enforcement. A student graduating from this course will be able to contribute to the development and management of AQM systems. The course will benefit: scientific officers at various levels in both public and private sector, environmental engineers in private sector, and consultants in fields like air quality investigations, environmental impact assessments, permits and certification, and regulation.

BIOLOGICAL WASTE TREATMENT

2.5 CREDITS

Course leader: Sebastian Schwede

Biological waste treatment is the recycling of humus, nutrients and/or energy from organic waste by aerobic (composting) and anaerobic (digestion) stabilization. The major challenge for waste treating companies is to offer both environmentally-friendly and cost-effective solutions and a save release of the residues to the environment. At the same time, regulatory restrictions decrease the limits for the release of potential contaminants and increase the recovery requirements. The course biological waste treatment will deepen the understanding of treatment technologies and processes for organic municipal waste from different sources with special focus sewage sludge and-organic municipal solid waste.

HERE PEOPLE MEET WHO WANT TO DEVELOP THEMSELVES AND THE FUTURE

Mälardalen University is one of Sweden's major higher education institutions, with a modern approach to teaching, located in one of Sweden's main business regions.

EDUCATION THAT LEADS TO EMPLOYMENT

Our students are attractive on the labour market. According to the Swedish Higher Education Authority, as many as 84 percent of MDH students find a job within their area of expertise within one year of graduating. Due to a long tradition of close relationships with municipalities, county councils, businesses and organizations, MDH has considerable competence regarding cooperation. Many of our study programmes are designed and evaluated together with private and public partners.

APPLIED RESEARCH

We focus on research that generates useful solutions for sustainable development of society and offer research studies in Engineering and Technology as well as Health and Welfare. Embedded Systems is considered cutting-edge both nationally and internationally, Future Energy is one of Sweden's strongest environments in process optimization targeting the process industry and the energy sector.

INDUSTRY COOPERATION

Over the years, our cooperation with society and local communities has become more and more intense and long-term. It takes place in the form of strategic agreements, platforms, research projects and study programmes.

MDH's cooperation activities and their outcomes benefit research and education, as well as the cooperating partners. Thanks to cooperation, research results can be transformed into concrete products and services, while students can complete job placements or degree projects with future employers, and the supply of competence and dissemination of knowledge in the region are ensured.

MAJOR INVESTMENT IN E-LEARNING

Autumn 2019 we launch a major investment in e-learning; the FutureE-project. The project is funded for the most part by the Knowledge Foundation, and the aim is to create a total of 12 second-cycle web based courses, in English, in Embedded Systems and Future Energy.

The course content will be produced in conjunction with industry such as ABB, Ericsson, Scania, Saab and Volvo and have a close connection with the research conducted at the University.

MÄLARDALEN UNIVERSITY
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Knowledge Foundation

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