JÖNKÖPING UNIVERSITY
School of Engineering

COURSE SYLLABUS – THIRD-CYCLE EDUCATION

# Computer systems for automated engineering design, 7,5 higher education credits

*Datorsystem för automatiserad konstruktion, 7,5 högskolepoäng*

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| **Education cycle:** | Third-cycle education |
| **Disciplinary domain:** | Industrial Product Realisation |
| **Subject area:** | Machine design |
| **Syllabus valid from:** | Course syllabus reviewed by RUF 2012-10-19, established 2013-04-24 by the dean (vd-beslut 2013/039) |
| **Revision 1:** | Revised syllabus accepted and valid from 2015-09-09 (by the associate dean of doctoral programmes**)** |

## Learning outcome

On completion of the course, the doctoral student must:

*Knowledge and understanding*
- Demonstrate broad knowledge of the theoretical foundations for design automation systems
- Demonstrate an understanding of the principles for how to plan, build, operate and maintain intelligent computer systems for automation of engineering design

*Skills and abilities*
- Demonstrate ability to analyze design processes in order to assess their suitability for automation-

*Judgement and approach*
- Demonstrate an over-all view of solution strategies and available computer tools
- Demonstrate a sound judgement of what aspects of design automation technology that form viable topics for scientific research

## Content

The purpose of the course is to study automation of engineering design from both theoretical and practical perspectives. Concepts and methods are introduced together with business processes, engineering tasks and product architectures suitable for automation. Essential is the matching of the business need and engineering tasks with solution strategy and realisation. Traditional and emerging computer technologies will be discussed as well as their underlying theory and working principles.

The following subtopics will be covered:

**Design automation as an engineering science.** Motives for design automation, visions for scientific and industrial future. Research questions and research methods.

**Introduction to design automation.** Survey of field. Knowledge used in engineering design. Classification of design tasks, knowledge categories, design methods. The design process and how this is simulated.

**Knowledge management for design automation.** How can the knowledge base of design automation systems be managed to support quality assurance and the creation of a corporate knowledge repository?

**Analyzing problem structure.** Graph theory and DSM to study how existing design knowledge should be processed to solve a given problem.

**Representation and processing of knowledge.** Principles for procedural systems, inference based systems, constraint based systems, Case Based Reasoning, optimization, neural networks.

**Automated product configuration.** Specification systems and product models, success factors for product configurators, a five step procedure to implement configurators in industry, product analysis – design for variety.

**Design automation in practical applications.** Planning design automation. Tools and methods. Implementation and maintenance. Examples of industrial systems.

## Type of instruction

The course is based on lectures where concepts, methods, tools, applications etc. are introduced and discussed. Computer tutorials will support hands-on experience of common design automation methods and home assignments carried out individually during the course supports an in-depth understanding and judgment.

## Prerequisites

Admitted to third-cycle program with a background in Mechanical Engineering, specializing in product development or related topics. Students who have corresponding knowledge obtained from experience or study of other disciplines will be considered on an individual basis.

## Examination and grades

Grading is failed or passed. The examination is based on compulsory lectures, laboratory assignments and home assignments. The grading scale is given below.

| Examination format | Extent | Scale |
|---|---|---|
| Compulsory lectures | 2 hec | F/P |
| Laboratory assignments | 2 hec | F/P |
| Home assignments | 3,5 hec | F/P |

## Course literature

Adrian Hopgood, *Intelligent systems for engineers and scientist*. CRC Press, 2001.
Lars Hvam, Niels Henrik Mortensen, Jesper Riis, *Product Customization, Springer-Verlag*, 2008.
Scientific publications
Slide handout