Study program / course: Mechanical Engineering

Type and level of study: Master academic studies

Course: CAD/CAM/CAE 2

Lecturers: Devedzic B. Goran, Vesna M. Mandic

Status of course: Obligatory course for module M_1, II semester

Number of ECTS: 6

Precondition: Engineering tools 2

The objective of course

Acquisition of knowledge in the field of advanced CAD / CAM / CAE technology and deeper understanding of the methodology of modern product development process. Attention is paid to solving of complex engineering and development problems related to automatization of product design, visibility study, numerical analysis and simulation of production processes, tool design, generation of procedures for triaxial (and multiaxial) CNC machines. Students are trained for the application of methods for product and processes data exchange and management within collaborative environment.

The outcome of course

At the end of this course the student will be expected to be able to:

- Apply concurrent engineering principles in integrated product and process development
- Apply principles of PLM and PDM systems, as well as principles of collaborative design
- model complex products and tools
- apply design for manufacturing principles
- embed models with other software applications, add-in modules, data and knowledge bases, create and apply macros, use knowledgeware techniques and e-catalogues
- model machining processes for triaxial (and multiaxial) CNC machines and create optimal machining strategies
- prepare CAD models of product and tools for meshing and further FE/FV numerical analysis
- recognize relevant process parameters for optimization and CAE analysis
- define parameters for FE/FV analysis, appropriate choice of type of FE elements, remeshing parameters, boundary conditions for quality simulation of multy-stage processes
- analyze CAE results and connect it with CAD/CAM system for further optimization

Syllabus

Theoretical study: Concurrent engineering principles. Complex surfaces modeling. Sheet metal modeling. Forging and casting parts. Complex products modeling. Tolerance management. DFMA product design principles. Design automation. Programming CAD/CAM/CAE systems. Application of macros and intelligent techniques. Electronic catalogs. Modeling procedures of the triaxial and multiaxial CNC machines. Selection of optimal machining strategies. Principles of product lifecycle management (PLM) and product data management (PDM). Collaborative design. Data exchange between the CA systems. Generation of FE mesh and remeshing, Material data base, machine data base, mathematical models on material behaviour, contact friction and heat transfer. Advanced defining of FE parameters. Optimization of processes through numerical experiments, target functions. Analysis of results. Visualization of results, 3D modeling, API. Connection of CATI with input/output VR devices.

Practical Studies: Exercises in PC classroom: CAD/CAM modeling, CAE analysis and optimization of processes. Visits to industrial plants, toolmakers and design offices. Seminar work.

Recommended reading

1. G. Devedžić, J. Maksić, S. Ćuković, S. Petrović: "3D product modeling – problems collection", Faculty of Mechanical Engineering, CIRPIS center, Kragujevac, 2009. (in Serbian)
2. G. Devedžić: "Softverska rešenja CAD/CAM sistema", Faculty of Mechanical Engineering, Kragujevac, 2004. (in Serbian)
3. G. Devedžić: "CAD/CAM technologies", Faculty of Mechanical Engineering, WUS Austria, 2009. (in Serbian)
4. V. Mandić: "Modelling and simulation in metal forming", Mechanical Engineering Faculty, WUS Austria, Kragujevac, 2005. (in Serbian)
5. V. Mandić: "Virtual Engineering", Mechanical Engineering Faculty, WUS Austria, Kragujevac, 2007. (in Serbian)
6. K. Lee: "Principles of CAD/CAM/CAE Systems", Addison-Wesley Longman 1999.

The number of hours of active teaching:				Other classes:
Theory: 2	Practical classes: 1.6	Other forms: 0.4	Research study: 0	1

Teaching methods

Teaching approach through lessons, exercises, independent work of students. Available CAD/CAM software (CATIA, DELCAM PowerMill), software for FE/FV numerical process simulation (Simufact, Stampack, CAMPform). Obligatory visits to industry.

Assessment

Pre-final exam obligations	points	Final exam	points
Activities during the classes:	**10**	Oral exam	**30**
Colloquiums(s) :	**30**		
Seminar(s) :	**30**		