

ME-416

Fundamentals of computer aided manufacturing

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Cursus	Sem.	Type
Mechanical engineering	MA1, MA3	Opt.
Microtechnics	MA1, MA3	Opt.
Mineur STAS Chine	H	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Written
Workload	150h
Weeks	14
Hours	5 weekly
Courses	3 weekly
Exercises	2 weekly
Number of positions	

Summary

The goal of this course is to expose the student to basic computer-aided manufacturing (CAM) modeling concepts, basic mathematical simulation, verification and optimization algorithms and methodologies and their applications. The students will practice their knowledge with modern CAM software.

Content

Introduction to CAM (computer aided manufacturing)
 Machine tools (composition, performance and morphology)
 Machining (cutting, tools, strategies, parameters, toolpaths, process plans)
 CN Programming / Post-Processing
 Process Planning
 Process Planning Modeling and Optimization
 The Pétri Net Process Planning Modeling Method
 Toolpath generation (3 axis)
 Machining cost estimation
 CAM Projects (machining simulation and comparison with real machining)

Keywords

Computer-aided manufacturing, toolpath generation, process planning

Learning Prerequisites**Important concepts to start the course**

- Understand the basic notions of the geometry of curves and surfaces (length calculations, tangent vectors, curvatures)
- Understand the parametric representation of curves and surfaces
- Realize, analyze and criticize a surface and volumetric model of a part
- Basic notions of control theory
- Basic notions of a structured programming language
- Basic notions of machining

Learning Outcomes

By the end of the course, the student must be able to:

- Realize milling simulation model of a prismatic part
- Analyze a milling simulation model of a prismatic part
- Critique a milling simulation model of a prismatic part
- Estimate the cutting forces during milling
- Manipulate the interaction between the CAM and the CNC systems and the basic principles of a post-processor
- Model machining process plans
- Optimize machining process plans
- Model the machining costs of a prismatic machined part

Transversal skills

- Assess progress against the plan, and adapt the plan as appropriate.
- Communicate effectively, being understood, including across different languages and cultures.
- Set objectives and design an action plan to reach those objectives.
- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Use a work methodology appropriate to the task.
- Use both general and domain specific IT resources and tools
- Evaluate one's own performance in the team, receive and respond appropriately to feedback.
- Identify the different roles that are involved in well-functioning teams and assume different roles, including leadership roles.

Teaching methods

The course includes ex-cathedra lessons for the presentation of the theoretical notions of the course followed up by theoretical exercises and modeling exercises on the computer.

Expected student activities

The students will have to work on the assigned modeling exercises on the computer in addition to the studying of the course material described in the documentation and presented in the classroom.

The students are organized in groups of two students when performing their modeling exercises.

The modeling exercises require an average of 5 hours of workload per week

Assessment methods

The students are graded in part by their reports on the modeling exercises and in part by a written exam at the end of the semester. The written exam is based on the entire material covered in the course and consists of theoretical questions and small exercises.

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes
Others	The students are supervised during their computer-aided exercise hours by a team of assistants including the responsible teacher. The students can ask for more supervising assistance according to their needs

Resources

Bibliography

Course material is distributed during the course

The following references are related to the contents of the course:

- Sculptured Surface Machining, B.K. Choi and R.B. Jerard, Kluwer Academic Publishers, 1998, Chapters 1, 5 et 6, Kluwer Academic, 1998
- Manufacturing Design, Production, Automation and Integration, by Beno Benhabib Marcel Dekker, 2003
- Principles of Process Planning: A logical approach, by G. Halevi and R. Weil, Springer, 1995
- e-Design: Computer-Aided Engineering Design, by Kunag-Hua Chang, Elsevier, 2016

Ressources en bibliothèque

- [Manufacturing Design, Production, Automation and Integration / Beno](#)
- [e-Design: Computer-Aided Engineering Design / Chang](#)
- [Sculptured Surface Machining / Choi](#)
- [Principles of Process Planning: A logical approach / Halevi](#)