# Fundamentals of Computer Aided Manufacturing

**Kyritsis Dimitrios**

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<thead>
<tr>
<th>Cursus</th>
<th>Sem.</th>
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<tr>
<td>Génie mécanique</td>
<td>MA1, MA3</td>
<td>Opt.</td>
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<td>Microtechnique</td>
<td>MA1, MA3</td>
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<td>Mineur STAS Chine</td>
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<td>Robotique</td>
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**Language**: English  
**Credits**: 5  
**Session**: Winter  
**Semester**: Fall  
**Exam**: During the semester  
**Workload**: 150h  
**Weeks**: 14  
**Hours**: 5 weekly  
  - Lecture: 3 weekly  
  - Exercises: 2 weekly  

**Summary**

Students will be exposed 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 by doing projects 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 practice on the computer in the form of projects.

Expected student activities
The students will have to work on the assigned modeling problems 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 when performing their modeling assignments in form of projects.
The projects on the modeling problems require an average of 5 hours of workload per week

Assessment methods
The students are graded by their reports on the modeling problems (80% of the grade). In addition to the project reports the students have to deliver a short presentation of their projects in the class at the end of semester (20% of the grade).

Supervision
Office hours
Assistants
Forum
Others
Yes
Yes
Yes
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 outside the class hours.

Resources
Bibliography
Course material is distributed during the course
The following references are related to the contents of the course:
• Manufacturing Design, Production, Automation and Integration, by Beno Benhabib Marcel Dekker, 2003

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