Code: ING-IND/13	Credits: 9
Matter: Applied Mechanics II	
Main language of instruction: Italian	
Other language of instruction: English	

Teaching Staff

Head instructor
Prof. Marco Cirelli - marco.cirelli@unicusano.it

Introduction

The teaching of the course "Applied Mechanics II" aims to students to learn theoretical knowledge and application tools for the design of mechanical systems and structural analysis. The course has been organized into two main parts.

In the first part, the student will learn about basical knowledge of 3D virtual modelling. The issues inherent in computer-aided design and virtual assembly of mechanisms will therefore be discussed.

In the second part, the concept of structural analysis using finite element methodology is studied.

Etivities will be carried out in both parts in order to put into practice the concepts learned.

Objectives

The course has been organized in five subjects. The first subject deals about Computer Aided Engineering (CAE). An overview about the advantages of the CAE use in engineering design is presented. A description of main CAEs software and about how they usually work is shown. The second subject contains knowledge about parametric tridimensional modelling. Sketch concept, 2-D and 3-D entities, geometrical constraints, basic and advanced 3D features are treated. The third subject is about virtual assembly. Concept of joints, static and dynamic assemblies, top-down and bottom-up assembly are discussed. Fourth and fifth subjects describe respectively theoretical and practical aspect of structural analysis by using Finite Element Method (FEM). The concepts of discretization, shape and typologies of elements, assembly of elements, constraints and load, material properties are addressed. The course focuses on the teach essential knowledge about novel

methodologies to design mechanical systems. The students will learn both theoretical and practical aspects of virtual prototyping.

The course contains a practical part consisting in:

- Create several 3D components
- Generate different assemblies to realize mechanisms
- Structural analysis of several mechanism

Practical part has to be carry out by using the commercial software *Autodesk Inventor.* The practical part has to be realized from the students **in autonomous way.**

Competencies:

- To learn essential knowledge about Computer Aided Engineering.
- To understand how a Computer Aided Design software works.
- To be able to design components in a virtual environment.
- To acquire the abilities to design parametric parts.
- To be able to design mechanical assemblies.
- To know essential knowledge about mathematical joints for the assemblies generation.
- To be able to design mechanisms both in bottom-up and top-down approach.
- To acquire experience in modeling, assembling and motion functionality evaluation of mechanisms.
- To know and understand the Finite Element Method.
- To be able to realize a tridimensional model and evaluate its structural integrity by using FEM.
- To acquire problem-solving skills in structural analysis based on quantitative and qualitative information.
- To be able to search for, interpret and convey information.
- To acquire the abilities to solve problems and make decisions using relevant information, applying the appropriate methods for structural analysis perform.
- To be able to organize the results and to write a complete report of the analysis.
- To be able to work with academic papers.
- To acquire skills for independent learning.
- To be able to create models, analyze it and assumes critical conclusions.
- To acquire the ability to put knowledge into practice.

Syllabus

Subject 1. Computer Aided Engineering
Subject 2. Virtual prototyping – Design of components
Subject 3. Virtual prototyping – Design of assemblies

Subject 4. Finite Element Method – Theoretical aspects
Subject 5. Finite Element Method – Practical aspects

Evaluation system and criteria

The assessments of course is based on the following criteria:
I) **Etivities evaluation:** every etivity has minimal requirements that must be reached from all students. In addition to these, optional requests are given. If the student satisfy optional requests, an extra bonus <u>can be assigned</u> to him.
II) **Final exam**:
An objective test or multiple choice answers, the student should tick the right answer.
- The wrong answer will less ½ right answer
- The unanswered questions will be evaluated as zero

Notice: all etivities have to be completed and sent to the Professor at least 10 days before the date of exam, in order to allow the revision.

Bibliography and resources

1. *Materials to consult: lecture notes by the Professor.*