

OCW 2015

SUBJECT GUIDE

“MATHEMATICAL VISUALIZATIONS AND ANIMATIONS”

1.- EXPLANATION

The subject "*Mathematical Visualizations and Animations*" offers the students of technical studies a tool that helps to consolidate their mathematical knowledge.

The program of symbolic calculation that is used in this subject is the software "Mathematica". Mathematica provides an enormous graphical potential allowing the students to solve a great variety of problems of engineering and to improve their spatial comprehension, since it allows the analysis of the problems from a graphical point of view. It offers the possibility to do simulations without great difficulty, changing the information once the problem is solved.

2.- OBJECTIVES

These are the objectives of this subject:

1. To visualize in a rapid and simple form a family of curves, making changes in the parameters that define the problem.
2. To make animations that improve considerably the interpretation of the objects we are studying.
3. To change the perspective into the surface visualization, to analyze the different sections with respect to the coordinate axes, to use graphs for the study of certain problems related with mathematics, etc.

We have created two types of materials:

- 1.- Learning material: Where the theoretical part is explained, as well as the possibilities that the software Mathematica offers to make graphical representations and animations.
- 2.- Exercises: Several exercises and their resolution using the software Mathematica are proposed.

3.- COMPETENCES

- To know and to handle correctly the instructions and symbols of the program Mathematica.
- To raise, to analyze, to solve and to generalize different types of mathematical problems associated with the engineering, by means of the utilization of a tool of symbolic calculation.
- To use Mathematica's graphical capacities in the resolution of mathematical problems.
- To use coherently the Information and Technology procedures associated with the deductive skills of the mathematics, so that the accomplishment of simulations is possible on the basis of the change of information of a mathematical problem.
- To learn how to detect problems of engineering that can be solved by means of mathematical software.

4.- REQUIREMENTS

The requirements to follow the subject are the following:

- To have passed the subject Mathematics of the first academic years of technical or scientific university studies, as the concepts learned in Mathematics will be used in the development of this subject.
- It is necessary to have installed the software Mathematica.

5.- TOPICS

This subject is formed by 10 different topics:

- Topic 1: First steps with "Mathematica".
- Topic 2: Representation of curves in explicit form.
- Topic 3: Representation of curves in implicit form.
- Topic 4: Representation of curves in parametric form.
- Topic 5: Representation of curves in polar coordinates.
- Topic 6: Other representations in the plane.
- Topic 7: Representation of functions of several variables.

Topic 8: Animation of graphs.

Topic 9: Graphical representation of surfaces.

Topic 10: Vector fields.

6.- METHODOLOGY

The development of the subject is based especially on practical exercises. In the theoretical part the utilization of the software Mathematica is explained and several examples are shown, which can help in the comprehension of the developed topics. After finishing the theory, a list of exercises is proposed; their resolution is also provided. Once all the topics have been studied, the students can measure in the self-assessment the knowledge that they have acquired in the subject.

7.- SCHEDULE

The student will require 4-5 hours to develop each lesson of this subject. It is recommendable to start with the theory and to understand the examples provided on it, before starting with the practical part. It is also recommended to study the lessons following the order in which they are presented. That is to say, start from the first lesson, continue with the second lesson, and so on.

The student will require about 4-5 hours to do the exercises of the self-assessment part.