62952 - 3D modelling with smart geometry

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	562 - Master's in Product Development Engineering
ECTS	4.5
Course	1
Period	Second semester
Subject Type	Optional
Module	---

1.Basic info

1.1.Recommendations to take this course

The student must have academic knowledge (bachelor) in visual disciplines, graphic engineering or computer graphics, especially those related to conventional 3D development product techniques: Solid modeling, generation by surfaces or CAD (mechanical or architectural). It is also desirable to have basic training in matters related to the launch of new products.

1.2.Activities and key dates for the course

In the official academic calendar they are reflected class periods and dates Deadline for submission of assignments. The theoretical and practical classes, as well as places to teach them are reflected in the schedules of the website of the EINA (EINA.unizar.es).
Relevant information will be communicated to students through the platform MOODLE teaching assistance that will support organizational and teamwork environment.

2.Initiation

2.1.Learning outcomes that define the subject

The student, for passing this subject, should demonstrate the following results ...

- Capacity to model products with organic appearance or complex surfaces.
- Ability to design variants or morphological mutations products by generative algorithms or other graphic editing techniques.
- Ability to use advanced digital sculpting tools.
- Capacity to integrate all geometric information from CAD standards with the techniques learned in this subject.
- Ability to optimize the 3D geometric mesh topology so that they can be used in subsequent processes such as, for example, manufacture of prototypes or using computer animation.

2.2.Introduction

The subject provides knowledge of geometric modeling to design products with complex morphology, that can not be represented by conventional computer-aided design. The students will experiment with various techniques to detail

design, biomimicry, anatomical patterns, or parametric forms obtained through complex iterations. Methods and techniques to optimize digital geometry basis of production or functional criteria are also discussed. The general contents of the subject are mainly practical. The student must integrate them into a systematic work by subtasks applied to an actual product.
It is an optional subject, but is especially valuable for professionals or researchers who wish to apply their knowledge in bio-inspired engineering or production of organic components and optimization of products for additive manufacturing techniques or reverse engineering fields.

3.Context and competences

3.1.Goals

- Complementary training for bachelor's degree, with learning specialized 3D modeling techniques.
- Provide the student resources for immediate implementation in their working environment, professional or researcher.
- Strengthen its ability to create new, non-viable products through other systems.
- Encourage creativity.

3.2.Context and meaning of the subject in the degree

This is a subject of 4.5 credits ECTs optional character (OPT) that fits in the second semester of the **Master's in Product Development Engineering.** Technologies that reviews can be linked with other subjects as, *"Comunicación y Presentación de Producto* " (OB) (62944), increasing the range of products to represent and improve the presentation of modeling jobs, especially when involving materials with properties complex or based on organic tissue mutations or optical. Acquired knowledge and skills are essential in the design of products such as splint by additive manufacturing so it is complementary to " *Diseño para fabricación aditiva* " (OPT) (62953).

3.3.Competences

- Ability to lead in bio-engineering projects.
- Ability to select and to use digital techniques to recreate anatomical or inspired by nature forms.
- Capacity to modify the topology of a mesh obtained by scanning so that it can be adapted to the needs of develop.
- Ability to obtain synergies and sustainable digital technologies. They are expanding their ability to adapt to complex or multidisciplinary projects.

3.4.Importance of learning outcomes

Learning outcomes of this course are essential to model rigorously products inspired by nature or based on anatomical patterns.
The revised by matter techniques accelerate the launch cycle stages, reducing production costs. Its contents can be decisve for product development when working in reverse engineering processes or redesign components.

4.Evaluation

The student must demonstrate that it has achieved the intended learning outcomes through the following evaluation activities:

A OPTION : Continuous Assessment

- REVIEW CASE STUDY RESOLVED BY TASK: Students must perform ten tasks are integrated in a particular case. These tasks determine the understanding of the subject and ability to apply learning and a subject chosen by him

and supervised by teachers. They are individual. Account for 75% of the total score.
- EXHIBITION of project or CASE RESOLVED: Collects and adapts the above tasks for public exhibition in digital platform support on selected education (MOODLE). This phase allows pooling of individual initiative of each student. It is 25% of the grade.
- The total score is evaluated on 10 points. To approve it must obtain more than 5 note.

B OPTION: Review/Final

- For those students who want this option or not exceeding the minimum qualification in the form of continuous assessment (5/10), a written test that consign 100% of the qualification to hold within the established exam schedule will be made by the EINA.

5.Activities and resources

5.1.General methodological presentation

It is a practical course based on innovative methodological foundations and rational academic resources. It is based on the use of tools 3D geometric modeling, appropriate to the level of a student of Master and oriented towards the study of complex or special cases. Power capacity analysis in development projects in line a production system and / or company. The individual work is the core of the tasks to be solved but the goal is the active dissemination of the results with the participation of other fellow students.

The course is designed for students to develop a continuous work throughout the course, structured tasks that make a real case of presentation of a product. In this sense, class attendance and monitoring of the proposed practical exercises are aspects that will help make better use of the subject and as a result to the achievement of the objectives. It is interesting that the student has personal attitudes such as initiative and visual creativity.

5.2.Learning activities

The course is planned to facilitate continuous and active student learning. Learning resources to be used to achieve this are:

- LECTURE: Taught by Professor the whole group. In these theoretical concepts of the subject, illustrated with examples to help understand and in which students are challenged to participate reasoning about theoretical concepts learned exposed.
- CLASS OF PROBLEMS: are taught in small groups if the number of students is high. In these classes the contents of the theory classes are strengthened by performing carefully selected problems to cover all relevant aspects.
- COMPUTER PRACTICES: They are organized so that students learn to handle various tools for product presentation. The goal is to get the student is able to interpret the results and question its validity. After each thematic block the development of a practical task, which must be delivered for continuous assessment is required.
- INDIVIDUAL WORK: Following kinds of problems students must solve independently other proposed task, similar to those made in class difficulty.
- TUTORIAL: In which the student is helped to resolve the doubts raised during learning.

5.3.Program

The following five conceptual blocks are set:

- BLOCK-01: 3D Modeling techniques of polygon meshes. Geometry and redesign of objects under construction considerations using polygons. Smoothing algorithms and subdivision surfaces. Organic topologies and strategies

for optimizing meshes of varying resolutión.
- BLOCK-02: Generative Design by parameters. Iterated polygonal systems for industrial product designg.
- BLOCK-03: Techniques and Tools digital sculpture with high-density polygon meshes.
- BLOCK-04: Retopology 3D models methods. Criteria for improvement 3D CAD models. Systems reducing the number of polygons to digitized objects. Decimation parameters.
- BLOCK-05: Special systems modeling based on polygon meshes: Modeling humans parameters. Biological form based generators.

COMPUTER PRACTICES:
Prac-01: Redesign a product based on 3D CAD to polygons.
Prac-02: Digital sculpture conformation.
Prac-03: Digital sculpture for detailing.
Prac-04: Unconventional sculpting techniques.
Prac-05: Redesign digitized product. Decimation and topology samples.

5.4.Planning and scheduling

These blocks will be developed through the following activities:
Classroom activities:
- 20 hours of lecture.
- 18 hours of computer practices (06 practices 03 hours)
- 07 hours of classes of problems and review of alternatives.
non-classroom activities:
- 7.5 hours of tutoring, presentation and evaluation of work done on the platform MOODLE academic assistance.
- 60 hours of personal work for the study of concepts and solving tasks proposed along the course.
The timing of the actual classes of theory and problems, as well as computer practice sessions, will the schedule established by the EINA, which will be available on its website. They will also be announced in MOODLE. The tasks must be submitted adjusting to preset schedule when students more compatible with their other subjects, and there is a deadline of delivery to meet the student decide in advance. The teacher will report its face tutoring hours in the office. MOODLE tutoring adjust to the academic schedules of the EINA.

5.5.Bibliography and recomended resources

The references of the subject are delivered to students during the semester, the necessary links appearing on the MOODLE 2 platform.