Course guide
270672 - CA - Computer Animation

Last modified: 13/07/2022

Unit in charge: Barcelona School of Informatics
Teaching unit: 723 - CS - Department of Computer Science.

Degree: MASTER'S DEGREE IN INNOVATION AND RESEARCH IN INFORMATICS (Syllabus 2012). (Optional subject).

Academic year: 2022 **ECTS Credits:** 6.0 **Languages:** English

LECTURER

Coordinating lecturer: NURIA PELECHANO GOMEZ

Others: Primer quadrimestre:
OSCAR ARGUDO MEDRANO - 10
ALEJANDRO BEACCO PORRES - 10
NURIA PELECHANO GOMEZ - 10

PRIOR SKILLS

The course assumes advanced C++ programming skills, computer graphics, and Artificial Intelligence.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEE1.1. Capability to understand and know how to apply current and future technologies for the design and evaluation of interactive graphic applications in three dimensions, either when priorizing image quality or when priorizing interactivity and speed, and to understand the associated commitments and the reasons that cause them.
CEE1.2. Capability to understand and know how to apply current and future technologies for the evaluation, implementation and operation of virtual and / or increased reality environments, and 3D user interfaces based on devices for natural interaction.

Generical:
CG1. Capability to apply the scientific method to study and analyse of phenomena and systems in any area of Computer Science, and in the conception, design and implementation of innovative and original solutions.

Transversal:
CTR4. INFORMATION LITERACY: Capability to manage the acquisition, structuring, analysis and visualization of data and information in the area of informatics engineering, and critically assess the results of this effort.

Basic:
CB7. Ability to integrate knowledges and handle the complexity of making judgments based on information which, being incomplete or limited, includes considerations on social and ethical responsibilities linked to the application of their knowledge and judgments.
CB9. Possession of the learning skills that enable the students to continue studying in a way that will be mainly self-directed or autonomous.

TEACHING METHODOLOGY

For this course the teacher provides theoretical lectures and materials (articles) for the students to read. During the lectures the students will learn the most important concepts regarding animation and simulation, and will receive advice and guidelines for the preparation and implementation of their programming projects.
During the laboratory classes, the students will receive further lectures focused on the relevant topics towards completing their programming projects, and will have time to work in the class being helped by the professor when needed.

LEARNING OBJECTIVES OF THE SUBJECT

1.When completing this course, students will understand the concepts behind animation and simulation in computer graphics applications. More specifically they will be able to understand and program algorithms for:

STUDY LOAD

Type	Hours	Percentage
Hours large group	51,0	34.00
Self study	96,0	64.00
Guided activities	3,0	2.00

Total learning time: 150 h

CONTENTS

Particle systems and collision handling

Description:
Particles are introduced as the simplest animation objects. General features like state vector, forces, energies, numerical solvers, etc., are defined together with interactions (collisions) with other scene objects. Simulation examples are explosions, fireworks, smoke, fountains and rain.

Mass-spring models

Description:
The mass-spring model allow us to animate more complex objects built from interrelated particles. Definition of the internal deformation forces. Examples are combined in their 1-dim (rubber-band, rope, etc.), 2-dim (cloth, flags, curtains, etc.) and 3-dim (soft bricks, jelly, etc.).

Rigid bodies and articulated chains.

Description:
Animation of single rigid bodies (spheres, dice, etc.) and their interaction. Articulated rigid body chains. Interaction between solid and deformable objects.

Navigation.

Description:
Cell and portal graphs, path finding, roadmaps.

Character Animation.

Description:
Keyframing, skinning, motion capture and motion graphs.

Crowd simulation.

Description:
social forces, rule based models, cellular automatas, precomputed search trees.

ACTIVITIES

Lectures

Description:
Material will be presented in lectures along the term.

Full-or-part-time: 70h
Theory classes: 26h
Laboratory classes: 24h
Self study: 20h

Programming Assignment 1

Specific objectives:
1

Related competencies :
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Full-or-part-time: 30h
Self study: 30h

Programming Assignment 2

Specific objectives:
1

Related competencies :
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Full-or-part-time: 30h
Self study: 30h

Student Presentation

Description:
Student Presentation

Specific objectives:
1

Related competencies :
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Full-or-part-time: 8h 30m
Guided activities: 0h 30m
Self study: 8h

Research publication report

Full-or-part-time: 8h
Guided activities: 1h
Self study: 7h

Attendance at other Student Presentations
Full-or-part-time: 3h 30m Theory classes: 3h 30m

GRADING SYSTEM

The course assessment is based on three types of activities:

- Projects: 80%
- Student Research report or exam 20%

BIBLIOGRAPHY

Basic:
- Pelechano, N.; Allbeck, J.M.; Badler, N.I. Virtual crowds: methods, simulation, and control. Brian Barsky. Morgan Claypool, 2008. ISBN 9781598296419.

Complementary:
- Eberly, D.H. Game physics. 2a ed. Morgan Kaufmann/Elsevier, 2010. ISBN 9780080964072.

RESOURCES

Hyperlink:
- http://www.cs.ubc.ca/~van/sca/sca.html- http://www.motioningames.org/