COURSE DESCRIPTION CARD - SYLLABUS

Course name
3D grapfics and visualization [N2AiR1-RiSA>PO2-WZG]

Course

Field of study
Automatic Control and Robotics

Year/Semester
2/3

Area of study (specialization)
Autonomous Robots and Systems

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
elective

Number of hours

Lecture
10

Laboratory classes
20

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

The student starting the subject should have a basic knowledge of linear algebra. One should also be able to obtain information from specified sources and be willing to cooperate as part of a team.

Course objective

The aim of the course is to familiarize students with the basic methods of 3D object representation, realistic visualization and animation used in computer graphics and to familiarize with the methods of acquisition, processing and visualization of scanned technical and medical data. The aim is also to familiarize with modeling and visualization of dynamic phenomena andoptical methods of data acquisition and processing in order to obtain technical measurement characteristics

Course-related learning outcomes

Knowledge
1. The graduate has extended and in-depth knowledge of selected mathematics departments necessary to formulate and solve complex tasks in the field of modeling, identification and signal processing.
2. The graduate has knowledge of development trends and the most important new achievements in the field of automation and robotics and related scientific disciplines.

Skills
1. The graduate can prepare documentation concerning the implementation of an engineering task in Polish and in a foreign language.
2. The graduate can designate models of simple systems and processes, and use them for the analysis and design of automation and robotics systems.
3. The graduate can simulate and analyze the operation of complex automation systems, plan and carry out experimental verification.
Social competences
1. The graduate is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture: written exam (checking theoretical knowledge)
Laboratory: Tests and exercise reports.

Programme content

The course includes methods of 3D representation of objects, transforming 3D-> 2D (projection), methods to improve the visual realism (illumination models, shading, texture).
Presented are ways to scan 3D objects and their formation using rapid prototyping technology. The course also includes the methods of spatial medical data acquisition (CT/MRI/PET) and their processing in order to obtain computer models. The rules will also be modelling of dynamic visualization and graphics. The course also includes an optical method of data acquisition and processing in order to obtain the characteristics of spatial objects used in modern measuring devices. Bioprinting.

Course topics

Lecture. The course includes methods of 3D representation of objects, transforming 3D-> 2D (projection), methods to improve the visual realism (illumination models, shading, texture), the method of computer animation and visualization of industrial processes, the creation of objects and components (mechanisms) in CAD systems and their representation in the form of two-dimensional technical drawings and animated 3D presentation. Presented are ways to scan 3D objects and their formation using rapid prototyping technology. The course also includes the methods of spatial medical data acquisition (CT/MRI/PET) and their processing in order to obtain computer models. The rules will also be modelling of dynamic visualization and graphics. The course also includes an optical method of data acquisition and processing in order to obtain the characteristics of spatial objects used in modern measuring devices. Bioprinting.
Laboratory: Modeling parts, mechanisms (assemblies), presentation of mechanisms, technical drawings (Autodesk Inventor). Modeling objects with arbitrarily shaped surfaces, taking into account texture. Rendering the scene, taking into account local and global lighting methods (Blender). Scanning objects using various scanners: 3D David Laser Scanner, Kinect, RealSense SR300, EinScan Pro+. Modeling and manufacturing objects using 3D printing (FMD technology), measuring object characteristics and comparing with the model. Modeling objects, simulation of deformations using FEM and comparing with the experiment performed in the laboratory.

Teaching methods

Lecture: multimedia presentation, illustrated with real-world examples.
Laboratory: exercizes using CAD software and devices (laser scanners, depth cameras)

Bibliography

Basic
1. J. D. Foley i inni, Wprowadzenie do grafiki komputerowej, WNT Warszawa.
2. M. Jankowski, Elementy grafiki komputerowej, WNT Warszawa
Additional
1. Handbook of Autodesk Inventor software.
2. Handbook of Blendr software.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	2,00