COURSE DESCRIPTION CARD - SYLLABUS

Course name

Scientific data visualization

Course

Field of study

Mechanical Engineering

Year/Semester

1/2

Area of study (specialization)

Virtual Design Engineering

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Wydział Inżynierii Mechanicznej

ul. Piotrowo 3 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

KNOWLEDGE: student has knowledge of information technology and knowledge of mechanical engineering, including engineering graphics and CAD

SKILLS: student knows how to use CAx software, including performing simple FEM simulations; can integrate the information obtained and interpret it

SOCIAL COMPETENCES: the student is aware of the responsibility for the tasks performed, understands the need to acquire new knowledge.

Course objective

Students acquire knowledge of systems and techniques related to data visualization and analysis. They

will learn about selected issues in the field of computational geometry (3D modeling, curves and parametric surfaces, triangulation) and the basics of rendering.

Course-related learning outcomes

Knowledge

K2_W07: Has knowledge of modeling, including the creation of a physical model, CAE (Computer Aided Engineering) systems, analysis of the results of simulations of complex mechanical systems using numerical methods; knows the basic concepts of modern methods of optimal design and their practical engineering applications.

K2_W10: Has knowledge in the field of CAD / CAM (Computer Aided Design / Computer Aided Manufacturing) systems, 3D geometric modeling methods, model visualization methods and procedures for using models for virtual product testing. Has knowledge in the field of integration of information flows, the use of IT tools supporting design; has the basics of knowledge to optimize construction solutions.

K2_W04: Has extended and in-depth knowledge enabling to link technical mechanics and strength of materials with computer techniques.

Skills

K2_U11: Can interpret natural and technical phenomena; can perform a simple calculation related to data processing, write a simple computer program to perform more complex calculations.

K2_U14: Is able to describe and basically use engineering software systems to support design, describe 3D geometric modeling methods, model and data visualization methods, and procedures for using models for virtual product testing.

K2_U01: Can integrate obtained information, interpret it and critically assess, as well as draw conclusions and formulate and comprehensively justify opinions.

K2_U04: Is able to determine the directions of further learning and implement the process of self-education, as well as direct others in this field

Social competences

K2_K01: Understands the need for lifelong learning; can inspire and organize the learning process of others.

K2_K04: Can adequately set priorities for implementation of the tasks specified by him or others.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Oral and written tests. Assessment of individually made projects.

Programme content

2D and 3D graphs. Geometry. 3D model. Parametric curves and surfaces. Data sources (numerical calculations, experiment, medical diagnostics). Visualisation. Techniques for data presentation - scalar

and vector fields, sections, isosurfaces, streamlines / web glyphs / vectors, volumetric visualization. Selection / determination of variables for visualization. Vorticity, linear integral convolution. Overview of the possibilities of visualization systems on the example of the selected software (e.g. ParaView). Data processing pipeline and filters (including those created in Python).

Applications of rendering in scientific visualization on the example of the Blender program.

Teaching methods

Information / problem lecture, Case study, laboratory with elements of project.

Bibliography

Basic

U. Ayachit. The ParaView Guide. Community Edition. http://paraview.org/paraview-guide/

http://www.bu.edu/tech/support/research/training-consulting/online-tutorials/introduction-to-scientific-visualization-tutorial/

M. Gągolewski, M. Bartoszuk, A. Cena. Przetwarzanie i analiza danych w języku Python. PWN, Warszawa, 2016. ISBN: 9788301189402

Additional

https://en.wikipedia.org/wiki/Scientific_visualization

https://en.wikipedia.org/wiki/Line_integral_convolution

http://www.bu.edu/tech/support/research/training-consulting/online-tutorials/paraview/

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,0
Classes requiring direct contact with the teacher	33	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	27	1,0

[1] delete or add other activities as appropriate