Real-time graphics and computational geometry 7.5 credits D7045E

Realtidsgrafik och geometriska algoritmer

Course syllabus admitted: Autumn 2023 Sp 1 - Present

DECISION DATE
2023-02-15

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Real-time graphics and computational geometry 7.5 credits D7045E

Realtidsgrafik och geometriska algoritmer

Second cycle, D7045E

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	G U 3 4 5	Datalogi	Computer Technology

Main field of study

Computer Science and Engineering

Entry requirements

Bachelor-level knowledge in computer science and specific knowledge corresponding to D0012E Algorithms and data structures, D0003E Real-time systems and D0020E Project in computer science.

Good knowledge in English equivalent to English 6.

Selection

The selection is based on 30-285 credits

Course Aim

This course treats theories, methods, and principle for programming interactive real-time computer graphics based on time-variant scenes.

After the course, the goal is that the student should know

1. efficient algorithms and data structures for time-variant scenes consisting of three-dimensional objects.
2. the various steps taken to construct a rendered image of a scene.
3. the fundamental transforms and algorithms applied in the construction of the previous item.
4. ways to improve and optimize the rendering process.
5. how real-time computer graphics is programmed using modern low-level API:s like OpenGL.
6. how graphics cards function and are built.

After the course, the goal is that the student should be able to

1. write programs that generate interactive real-time computer graphics for time-variant scenes using low-level API:s like OpenGL.
2. create, analyze, and evaluate algorithms and data structures for building and representing scenes with three-dimensional objects so functional requirements are fulfilled.
3. create, analyze, and evaluate programmable solutions to the problems concerning the production of real-time computer graphics based on scenes with three-dimensional objects.
4. formulate and implement optimization algorithms for real-time computer graphics.
5. work together with other students and plan, carry out, and report the result of projects that results in software elements of time-variant real-time computer graphics both in writing and orally.

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Contents

The course focuses on theory, methods and principles for computer-based systems containing real-time graphics as well as algorithms and data structures for computer graphics and geometry.

Practical programming of interactive real-time computer graphics. Algorithms and data structures for 1) representing and constructing three-dimensional scenes with curves, surfaces, and compound objects, and 2) the rendering of real-time computer graphics (the pipeline). Geometric transforms. Rasterization. Pixels. Fundamental algorithms for computer graphics. Optimization of the rendering process. Optical surface properties. Lighting and texturing.

Realization

Each course occasion´s language and form is stated and appear on the course page on Luleå University of Technology's website.
The teaching consists of lectures on theory and some supervision at lab sessions. Laboratory work is carried out in a computer lab. Most lab work is done individually but some could also be done in groups. Homework assignments that render credit marks on the subsequent written exam may also occur during the course.

Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided. Examination consists of a final written exam and mandatory programming assignments during the course. Passing the lab assignment part of the course requires a passed grade on all individual assignments.

The grade on the final exam is the final grade.

The course goals are examined as follows:

Goals 1, 2, 3, 4, 5, 6, 8, and 9: Written exam.
Goals 2, 5, 7, 10, and 11: Laboratory work.

Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term "unauthorized aids" refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

Course offered by

Department of Computer Science, Electrical and Space Engineering

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0002	Written exam	G U 3 4 5	3.5	Mandatory	A19	
0003	Laboratory work	U G#	4	Mandatory	A23	

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Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

Last revised

by Robert Brännström 2023-02-15

Syllabus established

by Jonny Johansson, HUL SRT 2019-02-15

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