

CS-341

Introduction to computer graphics

Pauly Mark

Cursus	Sem.	Type
Communication systems minor	E	Obl.
Communication systems	BA6	Opt.
Computer science minor	E	Obl.
Computer science	BA6	Opt.
Electrical and Electronical Engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	6
Session	Summer
Semester	Spring
Exam	Written
Workload	180h
Weeks	14
Hours	5 weekly
Lecture	2 weekly
Exercises	1 weekly
Practical work	2 weekly
Number of positions	

Summary

The students study and apply fundamental algorithms for realtime rendering and geometry synthesis. They design and implement their own interactive graphics programs using the OpenGL graphics API.

Content

This course provides an introduction to the field of Computer Graphics with a focus on image synthesis. We will first cover the basic mathematical concepts, such as 2D and 3D transformations, examine the interaction of light with geometry to derive suitable shading models, and discuss elementary rendering algorithms, such as rasterization or visibility computations. We will then investigate how these fundamental components are integrated in current graphics processors and study the corresponding programming APIs, in particular OpenGL.

Students will experiment with modern graphics programming and build small interactive demos in OpenGL.

Complemented by some theoretical exercises, these programming tasks lead to a graphics software project, where small teams of students design and implement a complete graphics application.

Keywords

Pixels and images, 2D and 3D transformations, perspective transformations and visibility, rasterization, interpolation and lighting, OpenGL graphics API, shader programming, texture mapping, procedural modeling, curves and surfaces

Learning Prerequisites**Required courses**

Nothing

Recommended courses

Linear Algebra

Learning Outcomes

By the end of the course, the student must be able to:

- Explain and apply the fundamental mathematical concepts computer-based image synthesis
- Implement a basic rendering pipeline based on rasterization and z-buffer visibility
- Explain the core functionalities of the OpenGL graphics API
- Develop simple graphics programs in OpenGL using shader programming

- Design and implement geometry synthesis methods based on procedural techniques
- Coordinate a team during a software project

Teaching methods

Lectures, interactive demos, theory and programming exercises, programming project, project tutoring

Expected student activities

The student are expected to study the provided reading material and actively participate in class. They should prepare and resolve the exercises, prepare and carry out the programming project. Exercises and project are done in groups of three students.

Assessment methods

Exercises and Project: 50%, Final Examination: 50%

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Bibliography

A list of books will be provided at the beginning of the class

Ressources en bibliothèque

- [Polygon mesh processing / Botsch](#)

Notes/Handbook

Slides and online resources will be provided in class

Websites

- <http://lgg.epfl.ch/ICG>

Prerequisite for

Advanced Computer Graphics