DHBW Mannheim, 2023
Syllabus: Computer graphics
1.1.2023. - 30.4.2023.

Official Course Website:

https://github.com/lorentzo/IntroductionToComputerGraphics

Lectures

1. Introduction
- Computer graphics: what and why
- Glimpse of image synthesis
- Course organization

Date: 18.1.2023.

2. Overview of image generation
Pillars of image generation
- 3D scene
- Rendering algorithm
- Image and display

Date: 18.1.2023.

3. 3D scene overview
Foundational elements of 3D scene:
- 3D objects
  - Shape representation
  - Material
- Light sources
- Cameras

Date: 1.2.2023.

4. Transforms

- 3D space
- Transformations
- Scene organization

Date: 1.2.2023.

5. 3D objects: mesh shape representation

- Polygon mesh
- Subdivision surfaces
- Mesh and rendering
- Mesh data-structures
- Mesh modeling and acquisition

Date: 1.2.2023.

6. 3D objects: parametric curves and surfaces, implicit surfaces

- Parametric curves
- parametric surfaces
- Implicit surfaces

Date: 8.2.2023.

7. 3D Objects: material

- Material observation
- Physics (optics) models for CG
- Material models in CG
  - Scattering models

Date: 8.2.2023.

8. 3D Objects: texture

- Texturing pipeline
- Image and procedural textures
- Texture and material modeling

Date: 15.2.2023.

9. Light

- Light and color
- Real-world light sources
- Light models
  - Physical lights
  - Non-physical lights
  - Environment illumination
- Shadows

Date: 22.2.2023.

10. Camera

- Real camera system
- Image formation
- Pinhole camera model
- Virtual pinhole camera

Date: 1.3.2023.

11. Rendering overview

- Rendering big picture
- Practical rendering
  - Ray-tracing
  - Rasterization
- Intuition via ray-tracing

Date: 8.3.2023.

12. Rendering: ray-tracing

- Ray-tracing overview
- Camera rays
- Intersections (visibility)
- Shading
- Light transport

Date: 15.3.2023.

13. Rendering: rasterization

- Rasterization: the visibility solution core
- Graphics rendering pipeline: using rasterization for rendering
- Graphics rendering pipeline: logical GPU model, API

Date: 22.3.2023.

14. Image

- Image-space effects
- Digital imagery
- Aliasing and anti-aliasing
- Scene to screen

Date: 29.3.2023.

Exam

Concepts and theory. Written, multiple choices, 30min.

Date: 29.3.2023.

Project

Project tasks is intended for the whole the semester.
Topics:

- Ray-tracing based rendering from scratch
- Rasterization-based rendering, animation and interaction in three.js
- Modeling and animation in Blender
- Custom: student proposal

Deadline: 8.4.2023.

Grading

Exam: 25 points
Project: 75 points (+15 if outstanding)