

Photorealistic Graphics

NPGR 004

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Course content and form

Advanced 3D computer graphics

- main topic: realistic rendering
- follows Introduction to Computer Graphics (NPGR003)

2/2 Z, Zk

- 90 min lecture every week
- 90 min lab every week
- practical examples, semestral project for the credit (C# ray-tracer)



Lecture overview I

Shading (2-3)

- more reflectance models (Strauss, Cook-Torrance, Oren-Nayar), shadow casting

Recursive ray-tracing (~3)

- algorithm principles, intersections, textures, speedup techniques

Anti-aliasing and sampling (1-2)

- sampling and image reconstruction, sampling methods, adaptive sampling



Lecture overview II

Monte-Carlo rendering basics (1-2)

- distributed ray-tracing (soft shadows, depth of field, motion blur, light dispersion...)
- advanced methods are covered by lectures of doc. Wilkie (e.g. Advanced 3D graphics for film and games)

Radiosity (1-2)

- principle (FEM formulation of the global illumination problem), form-factors, radiosity system of equations

Contemporary rendering (2-3)

- modern Monte-Carlo rendering (depends on spare time)



Pharr M., Humphreys G.: *Physically Based Rendering: From Theory To Implementation*, Morgan-Kaufmann, 3rd edition, free online edition, (<https://www.pbrt.org/>)

A. S. Glassner (ed.): *An Introduction to Ray Tracing*, Academic Press, London, 1989

Peter Shirley et al: *Fundamentals of Computer Graphics*, 3rd edition, AK Peters, 2009

A. S. Glassner: *Principles of Realistic Image Synthesis*, Morgan Kaufmann, 1995



Literature

E. Veach: *Robust Monte Carlo Methods for Light Transport Simulation*, PhD, Stanford, 1997

Peter Shirley, Keith Morley: *Realistic Ray Tracing*, 2nd edition, AK Peters, 2003

J. Foley, A. van Dam, S. Feiner, J. Hughes: *Computer Graphics, Principles and Practice*, 2nd edition in C, Addison-Wesley, 1997



Requirements

Basic programming

- algorithms, data structures, OOP

Basics of programming in C#

- no in-depth knowledge of language or libraries is needed

Basic analysis and linear algebra

Introduction to Computer Graphics

- the actual knowledge, no formal pre-requisite



References

General information about the lecture, CGG

- <https://cgg.mff.cuni.cz/>
- <https://cgg.mff.cuni.cz/~pepca/>
- <https://cgg.mff.cuni.cz/~pepca/lectures/npgr004.current.en.php>

Labs, practical exercise

- <https://cgg.mff.cuni.cz/~pepca/lectures/cv/npgr004.en.php>
- <https://github.com/pepcape/RT004>