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# Computer Graphics III

## Winter Term 2015

### Organization

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# Contents and form

- **Advanced 3D computer graphics**
  - Loosely follows-up on *Computer Graphics II* (NPGR004)
    - Assumes knowledge of **ray tracing**
  - Main topic
    - **Realistic image synthesis**
    - **Global illumination**
- **2/2 C + Ex**
  - Lecture once a week
  - Labs follow the lecture in SW1

# Lecture overview 1/2

- **Physical and mathematics fundamentals of image synthesis**
  - Light, radiometry, light reflection, rendering equation.
- **Monte Carlo integration**
  - Statistical estimators and their properties, variance reduction techniques, combined estimators.
- **Solution of the rendering equation via MC**
  - Path tracing

# Lecture overview 2/2

- **Advanced image synthesis methods**
  - Bidirectional path tracing, photon mapping, irradiance caching, virtual point lights, Metropolis light transport, ...

# Labs

- **Pen-and-paper exercises on the material from lectures** (solution of problems)
- **Programming assignments**
- **Student's presentation of scientific papers**

# Evaluation – Points

## ■ Programming assignments

- **Max 45 pts** altogether for the assignments
- Penalty of 50% pts for each week of delay in delivering any assignment
- Extra points can be gained for extended assignments (max 10 pts)
  - Serves to compensate for loss of points
  - Altogether, **max 55 pts** from the assignments (including the extra points)

## ■ Paper presentation

- Max 10 pts

## ■ Final oral exam

- 0 – 45 pts

# Evaluation

- 1 (výborně) 86 – 100 pts
  - 2 (velmi dobře): 71 – 85 pts
  - 3 (dobře): 51 – 70 pts
  - 4 (Fail, nevyhověl/a): 0 – 50 pts
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- In order to pass, students must obtain **at least 50% of points for each item** on the previous slide (including the final oral exam)

# Final examination

- Oral
- **Three questions** in total
  - **Two questions** on the material covered in the lectures
    - Randomly selected from a list posted on the class web page
  - One question = discussion of a scientific paper
    - a) Students choose three papers during semester
      - The paper topic should be related to realistic rendering
      - Great source: <http://kesen.realtimerendering.com/>
    - b) I approve the students' paper choice
    - c) At the exam, I pick one of the three and the student explains what the paper is about

# Literature

- **M. Pharr, G. Humphreys: *Physically-based Rendering: From Theory to Implementation*, 2nd ed. Morgan Kaufmann, 2010.**
- M. Cohen, J. Wallace: *Radiosity and Realistic Image Synthesis*, Academic Press, 1993. (Kapitola 1-2)
- E. Veach: *Robust Monte Carlo Methods for Light Transport simulation*, Ph.D. Thesis, Stanform University, 1998.
- P. Dutré, Global Illumination Compendium, <http://people.cs.kuleuven.be/~philip.dutre/GI/>