Monte Carlo rendering 101

15-463, 15-663, 15-862
Computational Photography
Fall 2018, Lecture 26

http://graphics.cs.cmu.edu/courses/15-463

Course announcements

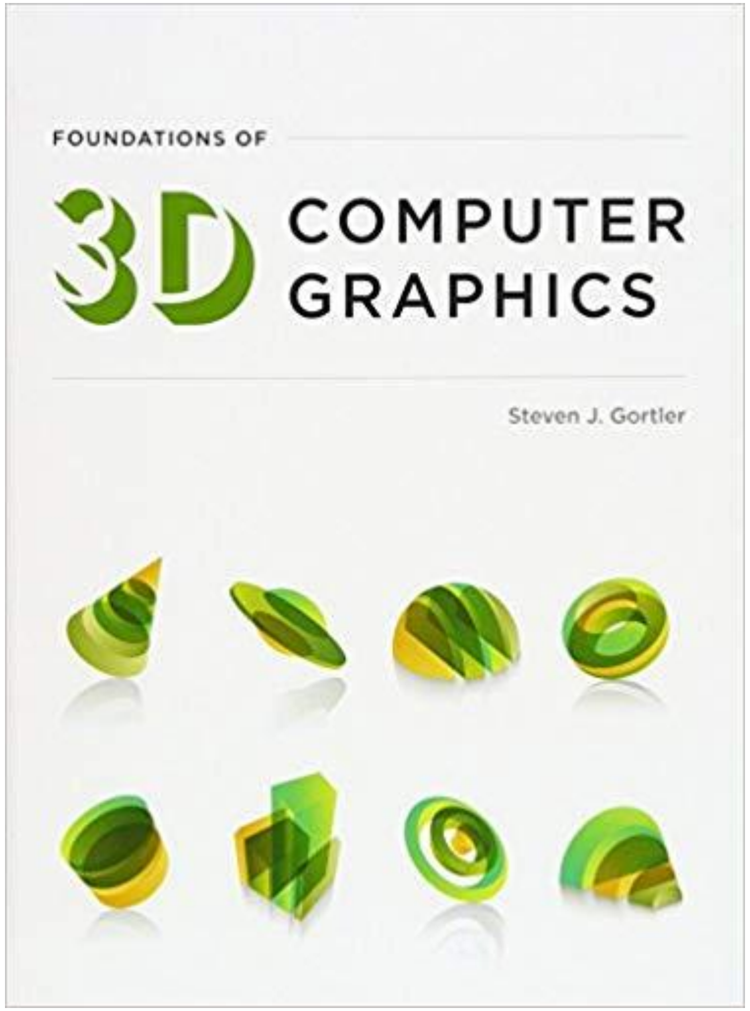
- Homework 6 is due Friday.
  - How is it going?

- Project checkpoint meetings.
  - Is there anyone who still haven't had their meeting?

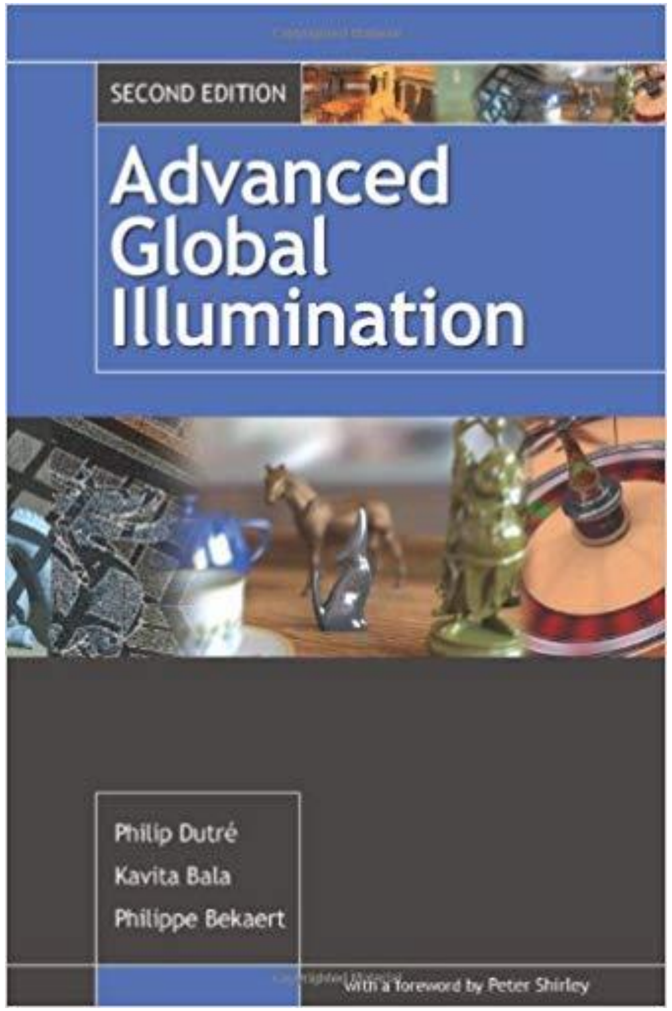
Overview of today’s lecture

- Direct illumination.
- Monte Carlo integration.
- Ray tracing.
- Global illumination.
- Path tracing.
- Path-integral formulation of light transport.
- Overview of path sampling algorithms.
- Operator-theoretic formulation of light transport.

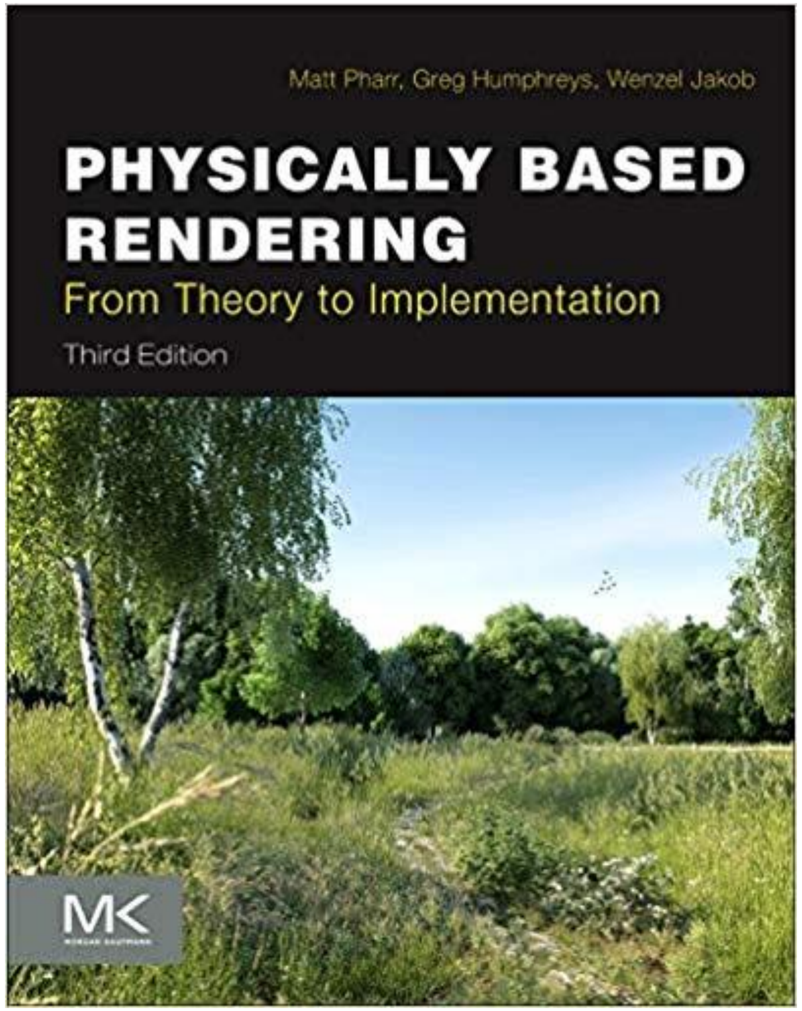
Useful references



Basic introduction. Focuses on general graphics foundations.



Good overview of theory, less emphasis on implementation.



Strong focus on implementation, some theory along the way.

Foundational theses

ROBUST MONTE CARLO METHODS
FOR LIGHT TRANSPORT SIMULATION

A DISSERTATION
SUBMITTED TO THE DEPARTMENT OF COMPUTER SCIENCE
AND THE COMMITTEE ON GRADUATE STUDIES
OF STANFORD UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

by
Eric Veach
December 1997

Exhaustive coverage of Monte Carlo rendering. Introduced most of the state-of-the-art techniques used today.

ANALYTIC METHODS FOR
SIMULATED LIGHT TRANSPORT

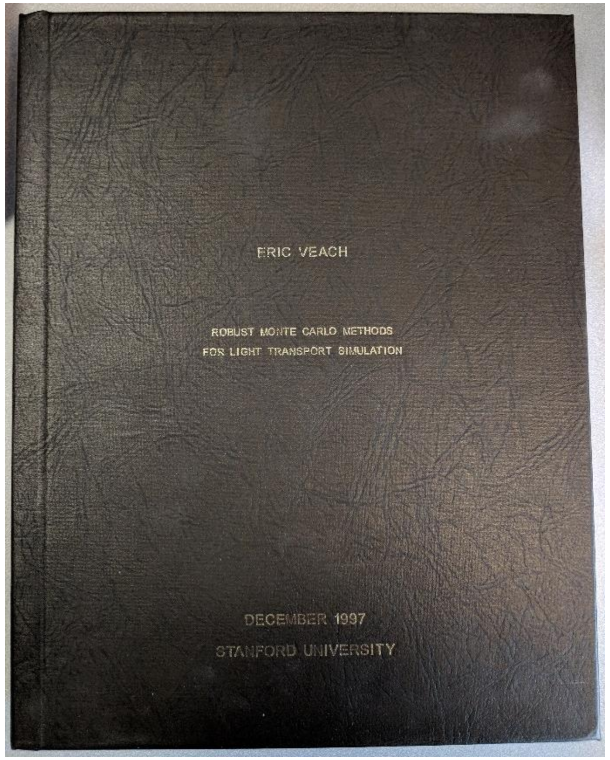
A Dissertation
Presented to the Faculty of the Graduate School
of
Yale University
in Candidacy for the Degree of
Doctor of Philosophy

by
James Richard Arvo
December 1995

Foundations of light transport, spanning measure theory, real analysis, and operator theory.

Testimonials

If you are doing anything related to rendering (duh), physics-based vision, or computational imaging, you should read at least Eric Veach's thesis.



So useful, I spent $150 to have it printed and bound into a book.

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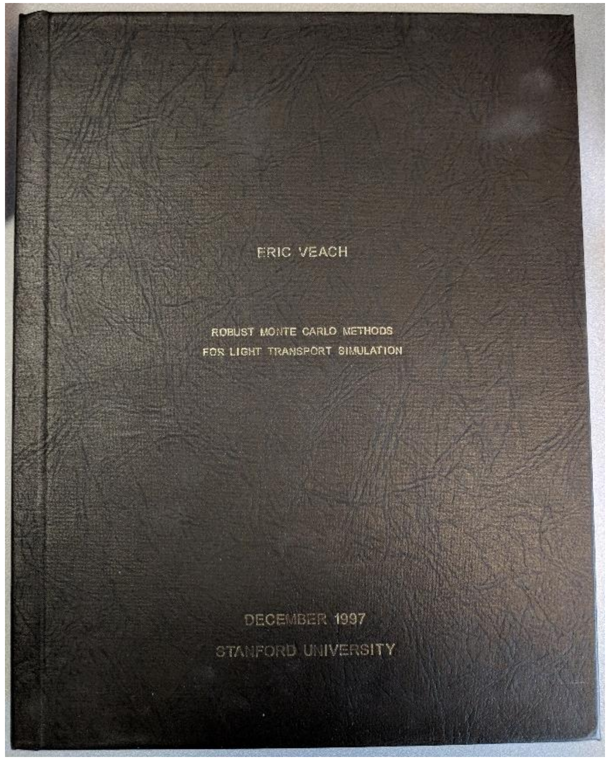

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Probably more importantly: Eric Veach won an Academy Award (a.k.a., Oscar) for it in 2013.

Interested in doing research in rendering? Talk to me!

Many, many possible projects, including:

- Transient rendering.
- Coherent lighting rendering.
- Differentiable rendering.
- Integration of rendering and deep learning.
- Inverse rendering for tissue imaging.
- Inverse rendering for non-line-of-sight imaging.

Four of last year’s 15-463/663/862 alumni did/are doing rendering projects.