Introduction

Dr. Rafael Kuffner dos Anjos

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Me

- Brazilian. Sorry about my inglês.

- I accept any pronunciation of my name that is not Ralph.

- Research in Graphics, mostly applied to VR/AR, and point clouds!

- Have collaborated with games/movie industry in Japan.

- I like most things (movies, games, books, food, animals, TV, sports, hobbies), except when it comes to music, which I'm very particular about.

- Office at 2.04d. Usually around Bragg building. Come meet me IRL and have a chat.

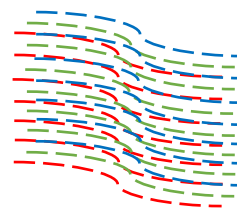- I have a wife, a baby, and a dog. You may get lucky and see them around.

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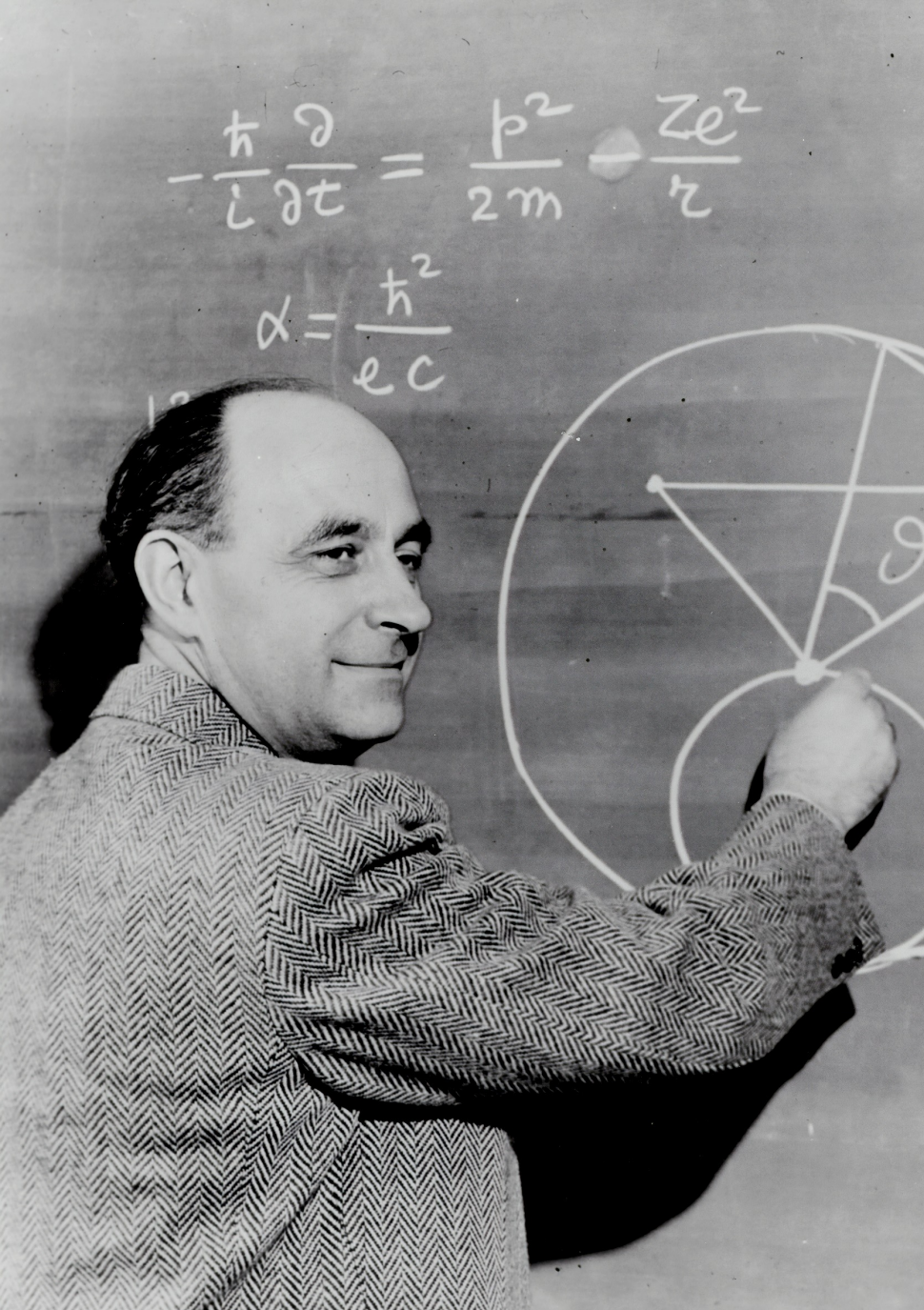
In this module

- Graphics is built on mathematics!

Objects

Light
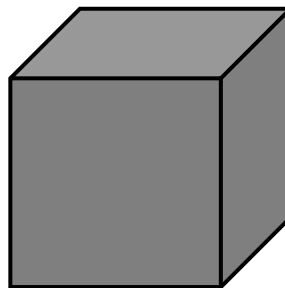
Images

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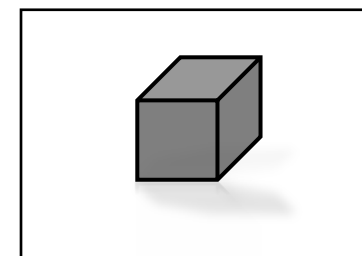
In practice

Data Intensive

Processor Intensive

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(Modelling &) Rendering

Our focus: rendering

Necessary to cover: Geometric models, Textures & Material properties

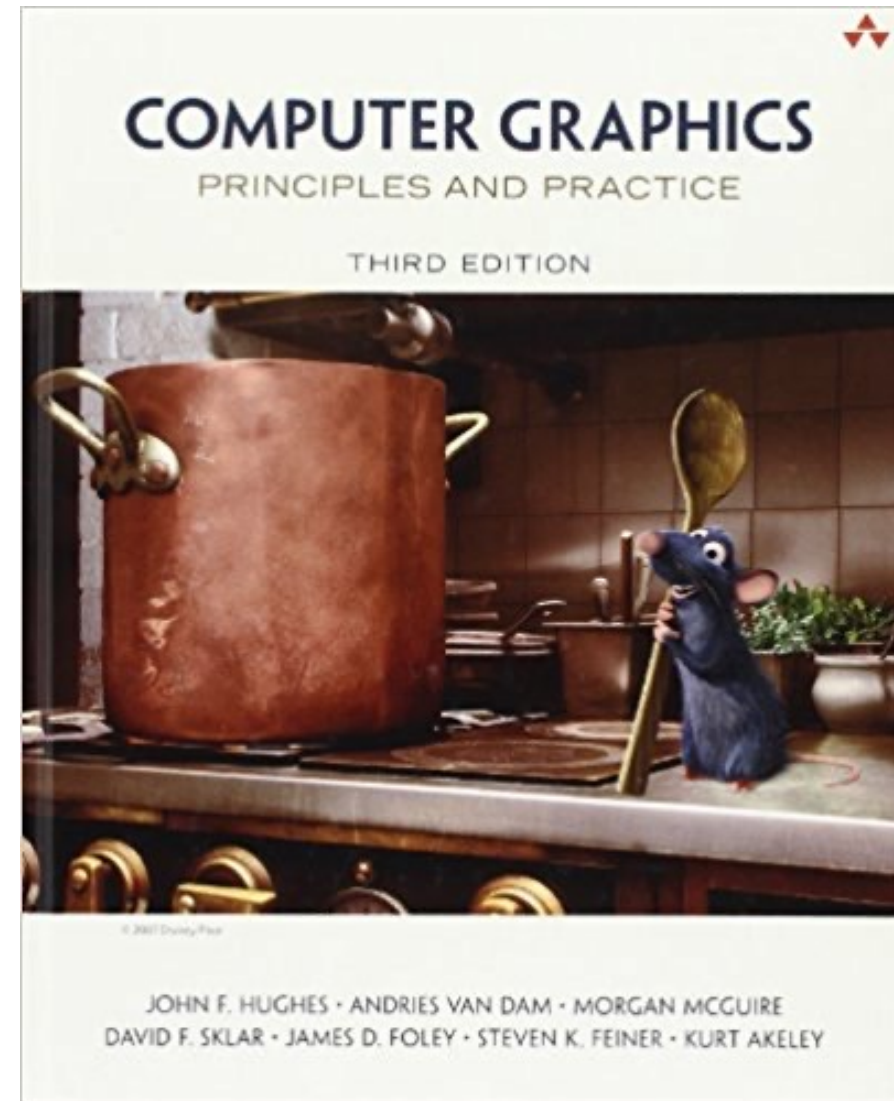More modelling is in Geometric Processing

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Rendering

- Barycentric Interpolation
- Geometric Intersection Tests
- Projective Rendering
- Physics of Light
- Materials & Scattering
- Rendering Solutions
- Parallel Implementations & Shaders

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Reference Text

- Some times 1 chapter/lecture other times several.

- Mostly reference, not strictly.

- Reading reference available on Minerva

COMPUTER GRAPHICS
PRINCIPLES AND PRACTICE
THIRD EDITION

JOHN F. HUGHES · ANDRIES VAN DAM · MORGAN MCGUIRE
DAVID F. SKLAR · JAMES D. FOLEY · STEVEN K. FEINER · KURT AKELEY
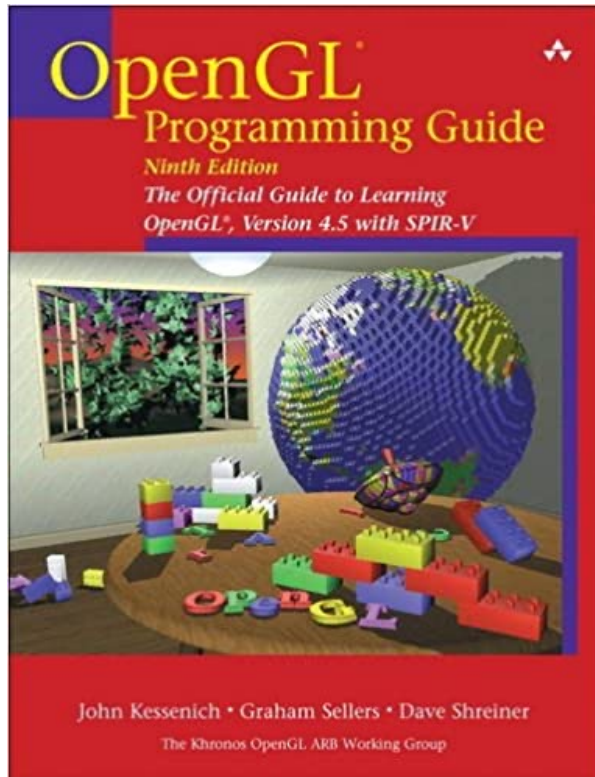
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Previous knowledge
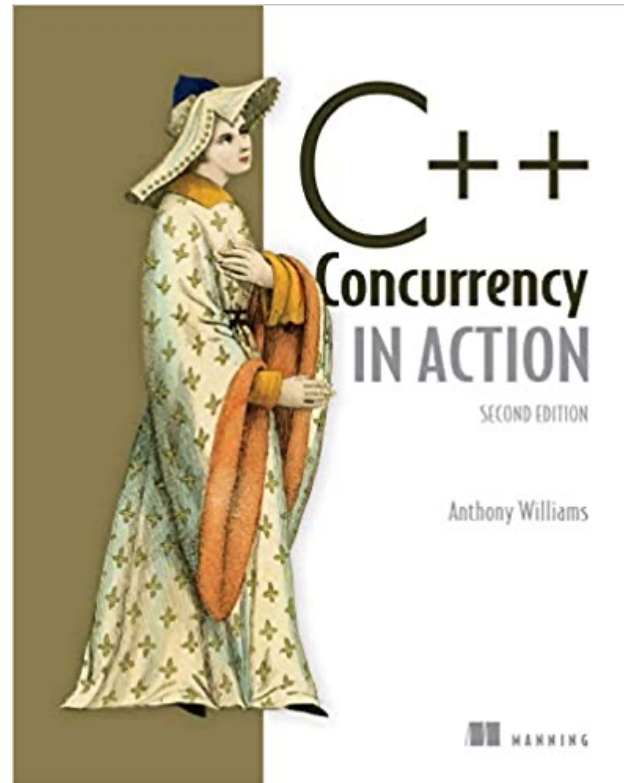
- We *assume* you know basic OpenGL (1.4)
  - Ch. 1-13 of the textbook
  - And basic Qt/other GUI development
- If you don't, it should also be okay!

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Support literature: Fixed Function Pipeline

Paperback: £33.99
Kindle: £29.16
ACM: $20.00

Paperback: £44.30
ACM: $20.00

Paperback: £38.24
Earlier versions online

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Raytracing
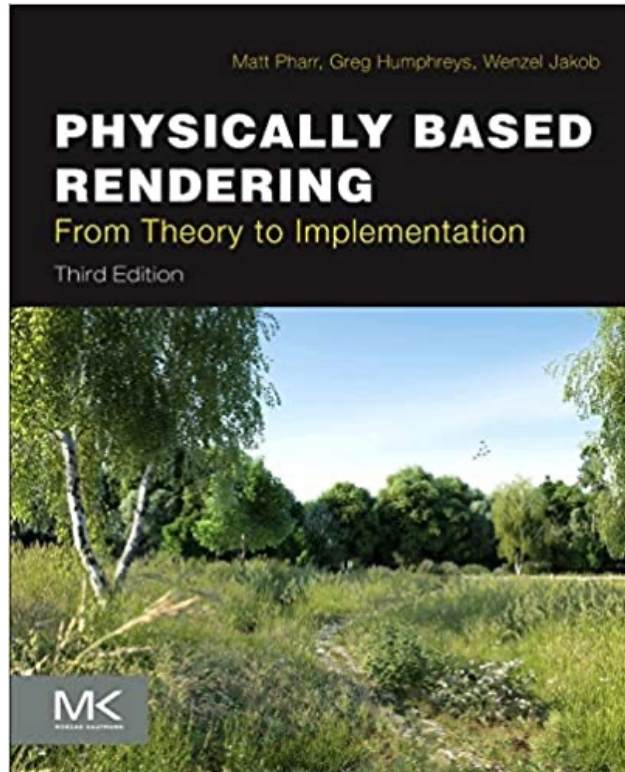
Online: £0.00
Academy Award
(Turing Award)

Online: £0.00

Hardback: £32.53
Kindle: £0.00

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Shader languages
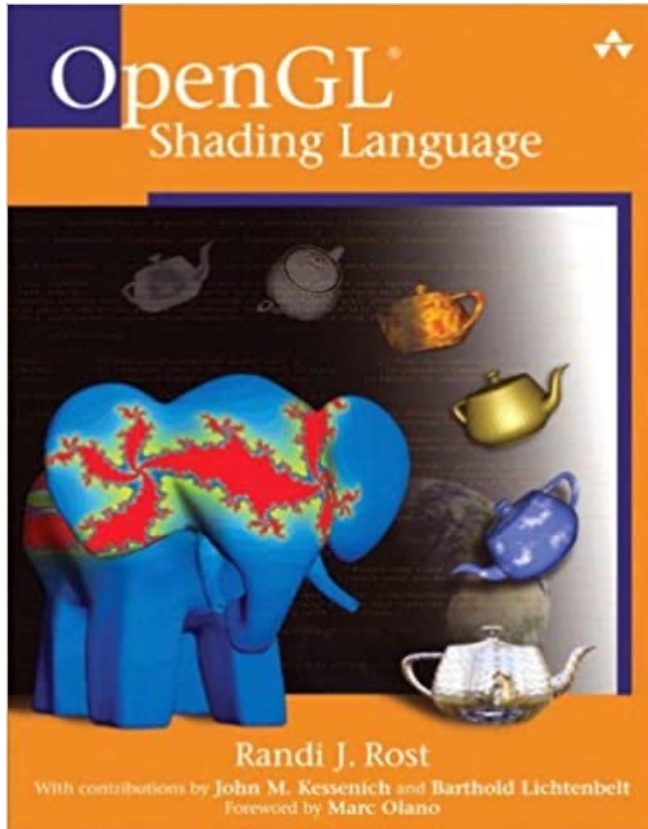
Paperback: £99.68
Kindle: £19.33
ACM: $20.00

Paperback: £34.99
Kindle: £29.16
ACM: $20.00

DirectX 12 Programming Guide

Microsoft: £0.00
(No Image)

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Evaluation

A1 (weeks 3-9): 50% — Parallel OpenGL Renderer in Software

A2 (weeks 9-14): 50% — Recursive Raytracer in Software

No Exam!

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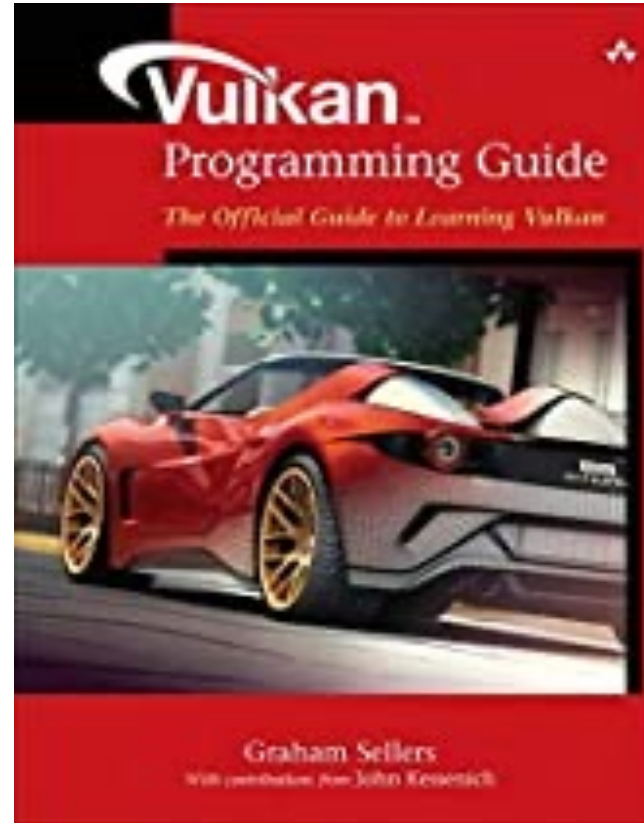| WEEK	DATES	WEDNESDAY	THURSDAY	LAB	IN	OUT
1	27 set - 01 oct	Projective Rendering	Homogeneous Transformations	Matrix exercise		
2	04 oct - 08 oct	Quaternions	Triangle Rasterisation & Shading	Quaternion Exercise		
3	11 oct -15 oct	Textures & Mip-maps	Parallel Implementation	Assignment 1 discussion		A1
4	18 oct - 22 oct	Shaders & GPU Architecture	Vertex Buffers	Assignment 1 support		
5	25 oct - 29 oct	Reading Week				
6	01 nov - 05 nov	GLSL Pipelines & Shaders	Building a Phong Shader	Assignment 1 support		
7	08 nov - 12 nov	Materials & Scattering	Geometric Intersections	Assignment 1 support		
8	15 nov - 19 nov	Monte Carlo Sampling	Recursive Raytracing	Assignment 2 discussion		
9	22 nov - 26 nov	Images & Filtering	Physics of Light & Colour	Assignment 2 support	A1	A2
10	29 nov - 03 dec	Alternate Rendering Methods	Non-Photorealistic Rendering	Assignment 2 support		
11	06 dec - 10 dec	Volume Rendering	Review	Assignment 2 support		
12	13 dec - 17 dec	No Lectures				
-	18 dec - 03 jan	End of year break				
-	03 jan - 07 jan	Study Week				
13	10 jan – 14 jan	Exam period				
14	17 jan – 21 jan	Exam period			A2	

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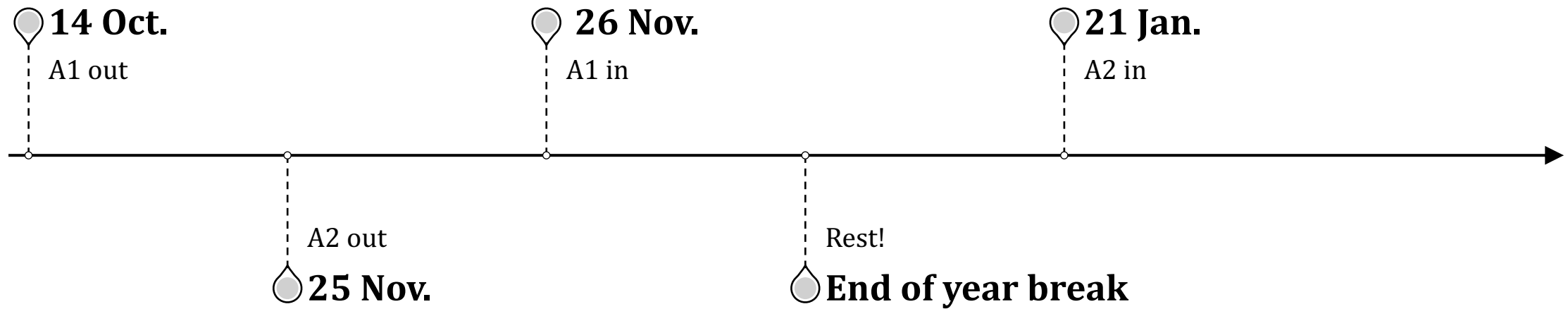
Where in the books?

Projective Rendering	Hughes 3,6,7,13
Homogeneous Transformations	Hughes 10,11
Quaternions	
Triangle Rasterisation & Shading	Hughes 6, 9.2
Textures & Mip-maps	Hughes 20
Parallel Implementation	Kessenich
Shaders & GPU Architecture	Hughes 33, Kessenich, Sellers
Vertex Buffers	Rost, Sellers
GLSL Pipelines & Shaders	Rost, Sellers
Building a Phong Shader	Rost, Sellers
Images & Filtering	Hughes 18, 19, 20
Physics of Light & Colour	Hughes 26, 28
Materials & Scattering	Hughes 27
Geometric Intersections	Hughes 7.7 - 7.8
Monte Carlo Sampling	Hughes 30
Recursive Raytracing	Hughes 15, 29, 31, 32
Alternate Rendering Methods	Hughes 15, 31
Volume Rendering	Hughes 27
Non-Photorealistic Rendering	Hughes 34
Review	

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Overview

- Maths fundamentals for computer graphics

- Rasterization

- OpenGL implementation

- Raytracing

- Alternate Rendering methods

Assignments:

Out on Thursdays,
In on Fridays,
always 10 am.

14 Oct.
A1 out

26 Nov.
A1 in

21 Jan.
A2 in

A2 out
25 Nov.

Rest!
End of year break

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Equipment & Labs

- We have access to the lab!!!!!!

- All the assignments can be done:
    - Using feng-linux.leeds.ac.uk(/gpu)
    - At home on your own machine
        - Windows / Linux / ? OS X ?
        - But *please* make it work on feng

- I assume QT 5.13.0 / OpenGL 4.5

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Lab Sessions

- Thursday 3.00-5.00 pm

- Shared slot with Geometric Processing

- First few weeks, exercises.

- Afterwards, Q&A session.

- Because of the maximum occupancy, we will be breaking you into 4 groups.

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Groups

- We will break it into 4 groups:
  - Group A will meet Hamish at 1500, me at 1530
  - Group B will meet me at 1500, Hamish at 1530
  - Group C will meet Hamish at 1600, me at 1630
  - Group D will meet me at 1600, me Hamish 1630

- Basically 2 slots: 15.00 and 16.00, and we do it all together.

Group A - 1500 HC, 1530 RK

M. Eng.

Matthew Cumber

Siyuan Fan

Isaiah Fergile-Leybourne

Alexander Goose

Jason (Zecheng) Hu

M. Sci.

Sharo Hama Karim

Niall Horn

Chaoshan Huang

Jason Kharmawphlang

Yichen Xiao

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Group B - 1500 RK, 1530 HC

M. Eng.

John Barbone

Sven Buckland

Vincent (Chan) Lou

Natasha Newland

M. Sci.

Nikhil Bharadwaj

Jiaxing Cai

Zekun Cai

Yiu Ho

Eleanor Mills

Shihua Wu

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Group C - 1600 HC, 1630 RK

M. Eng.

Ciaran Brennan

Lewis Hadley

Parmvir Grewal

Tomas Martinek

M. Sci.

Yizhou Hu

Huayang Jiang

Wei Pan

Tianyi Yan

Jingyuan Zhang

Zhiyang Zhang

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Group D - 1600 RK, 1630 HC

<u>M. Eng.</u>

Domantas Dilys

Mario Ivanov

Ramal Cooray

Usama Usman

<u>M. Sci.</u>

Jacob Bennett

Zechen Geng

Sharjeel Qaiser

Yuxuan Wen

Xiaoyuan Yang

Jinyun Zhu

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- From Unsplash.com

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