CS/ECE 413 Introduction to Ray and Vector Graphics

Fall 2014

Instructor:
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Textbook:
Ray Tracing from the Ground Up by Kevin Suffern

Description:
Topics include ray-geometry intersections, viewing, lenses, local/global illumination, procedural textures/models, spline curves and surfaces, and statistical integration for realistic image synthesis. Students will write a raytracing renderer from scratch, exploring high performance implementations and realistic rendering.

Grading:
- 70% Programming Projects.
- 30% Class Participation (show & tell, code reviews, analysis of algorithms and designs, and discussions of assigned readings, presentation of assigned questions and exercises).

Group Projects:
Most (if not all) of the assignments will be specified as individual, however, those of you wanting to work in pairs may, with case-by-case permission and respecification, do so.
Syllabus:

Week 1
- General Concepts of Ray Tracing
- Some Essential Mathematics
- Bare-Bones Ray Tracing Application

Week 2
- Anti-aliasing
- Sampling Techniques

Week 3 & 4
- Mapping Samples to a Disk & Hemisphere
- Perspective Viewing
- A Practical Viewing System

Week 5 & 6
- Depth of Field
- Nonlinear Projections
- Stereoscopy

Week 7, 8 & 9
- Theoretical Foundations
- Lights and Materials
- Specular Reflection
- Shadows
- Ambient Occlusion

Week 10 & 11
- Area Lights
- Ray-Object Intersections

Week 12 & 13
- Affine Transformations
- Transforming Objects
- Regular Grids
- Triangle Meshes

Week 14 & 15
- Mirror Reflection
- Glossy Reflection
- Global Illumination
- Simple Transparency
- Realistic Transparency

Week 15 & 16
- Texture Mapping
- Procedural Textures
- Noise-Based Textures