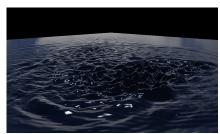## MAT 594G / CS 280: Advanced Computer Graphics
University of California, Santa Barbara — Fall 2012

Instructor: Theodore Kim, kim@mat.ucsb.edu
Teaching Assistant: Sahar Sajadieh, sahar@mat.ucsb.edu

Lecture: Tuesdays and Thursdays, 3 PM to 4:50 PM, Phelps 2516

Course Description

This course will cover advanced computer graphics topics in rendering, animation, and modeling. Topics may include, but are not limited to: programmable shading, General-Purpose GPU (GPGPU) computing, rigid body dynamics, OpenCL programming, physically based animation, subdivision surfaces, shadow algorithms, character skinning methods, ambient occlusion, and fractal growth algorithms.

Prerequisite(s)

We will assume that you have taken an introductory computer graphics class. You should know how to open and control an OpenGL window, be familiar with the basic ray tracing algorithm, and be comfortable reading and writing C/C++.

Grading Scheme

- **Homework assignments, 25%:** Homeworks will be assigned in C/C++ and will involve implementing the techniques discussed in class.

- **Paper presentation 25%:** You will select one recent paper from the literature that interests you and give an in-depth presentation to the class.

- **Project 50%:** The class will culminate in a project of your choosing. The project can be an implementation of a large, non-trivial technique, or a trial implementation of a novel technique of your own design. You are encouraged to pursue projects that align with your own research interests, and that may lie outside the bounds of more traditional research.

Textbooks

There is no required textbook, as there are plentiful free online resources on the topics covered in class. There are several recommended references:

- The RenderMan Companion - Steve Upstill
- The OpenGL Shading Language - Randi Rost et al.
- Real-Time Rendering - Tomas Akenine-Möller, Eric Haines, and Naty Hoffman

If you need introductory textbooks, the following are highly recommended:

- Fundamentals of Computer Graphics - Peter Shirley et al.
- The OpenGL Programming Guide - Dave Schreiner

The following websites are also good resources:

- The OpenGL Programming Guide, Version 1.1
- Ke-Sen Huang's graphics papers collection
- The Open Dynamics Engine
- The Bullet Physics Engine

Tentative Course Outline ───────────────────────────────

- **Week 1:** Overview and Introduction
- **Week 2:** The RenderMan Shading Language (RSL)
- **Week 3:** The GL Shading Language (GLSL)
- **Week 4:** General Purpose GPU Programming: OpenCL and CUDA
- **Week 5:** Shadow Algorithms and Ambient Occlusion
- **Week 6:** Rigid Body Dynamics Engines
- **Week 7:** Ocean Simulation Algorithms
- **Week 8:** Geometry and Subdivision Surfaces
- **Week 9:** Character Rigging and Animation
- **Week 10:** Final Projects