Spring 2014

CS277 - Experimental Haptics

Course Description

The Experimental Haptics course covers the field of computer haptics as it relates to computing force or touch feedback in virtual environments. The goal is to develop virtual reality simulations and applications that incorporate haptic interaction.

Theoretical topics include haptic rendering in 3-D virtual environments, simulation of haptic interaction with rigid and deformable objects, haptic interfaces, psychophysics of touch. Applied topics include an introduction to the CHAI 3D haptics library, implementation of algorithms for haptic rendering, collision detection, and deformable body simulation.

Meeting Times & Location

The class meets on Tuesday and Thursday, at 11:00-12:15 in Building 200, Room 202.

Teaching Staff

J. Kenneth Salisbury
office: Clark E100B

Sonny Chan
office: Clark E100, BioRobotics Lab (near Prof. Salisbury's office)

François Conti
office: Gates 118

Please direct course-related inquiries to cs277-spr1314-staff@lists.stanford.edu. This will allow all the teaching staff to see and respond to your message in a timely manner.

Prerequisites

Students are expected to have the following background:

- Knowledge of basic computer science principles and skills, and familiarity with programming in C++.
- Some familiarity with computer graphics (CS148 or CS248) and robotics (CS223a) is recommended but not required.

This is a computer science course, and no background in mechanical engineering is assumed. Mechanical engineering students are welcome (and encouraged) to take the class, as long as they are comfortable with basic C++ programming and willing to learn a little about computer graphics. The final project may also be tailored to involve hardware design and implementation (with instructor approval).

Course Materials

Slides presented in lecture will be posted on the class webpage. In addition, one or more relevant conference or journal papers will be posted on the webpage for each lecture. The course web site is located at

- http://cs277.stanford.edu/

There is no required text for this course. However, if you do feel inclined to purchase a textbook for current and future reference, you may find the following suggestion useful:

- Ming Lin and Miguel Otaduy. *Haptic Rendering*. A K Peters, 2008.

You will also need access to a haptic interface in order to complete the programming assignments in this course. For this purpose, a Novint Falcon device will be provided to each registered student on loan for the duration of the quarter. Should you wish to purchase your own device (these are great, robust devices available at an incredible price!), you can do so directly from Novint Technologies, Inc. for about $250 at

- http://www.novint.com/index.php/store

This course will also be using a Piazza forum to facilitate Q&A for issues regarding the programming assignments, and to help you find a partner for the course project. You can sign up to an access the site at

- https://piazza.com/stanford/spring2014/cs277

Coursework & Grading

The final grade for this course will be distributed as follows:

15%	Programming assignment #1
15%	Programming assignment #2
15%	Programming assignment #3
15%	Programming assignment #4
10%	Project milestone/presentation
30%	Final project

The first four homework assignments will give the student the opportunity to learn and make use of the CHAI 3D libraries while implementing some of the fundamental haptic rendering algorithms and techniques presented in class. While we encourage you to ask questions and discuss concepts with fellow students, you must complete and submit these assignments individually. You are expected to follow the CS Honor Code guidelines as described at http://csmajor.stanford.edu/HonorCode.shtml. **All assignments must be completed to receive a passing grade in the course.**

The suggested final project for the course is a haptics-enabled video game, simulation, or implementation of an advanced algorithm or technique described in a research

paper. Alternative projects may be undertaken, subject to instructor approval, provided they are of comparable scope and have sufficient depth. It is generally expected that the commercial haptic devices provided for the programming assignment will also be used to run the simulation or play the game, but alternate arrangements can be made as needed.

Projects will be graded and judged on creativity, quality of implementation, wow-factor, and mostly on their effective use of haptics toward providing a unique experience. **Students may work in teams of two to complete the final project.**

There will be no final exam in this course.

Submission of Coursework & Late Policy

Programming assignments must be submitted no later than 11:59 PM on the day they are due. The means for submitting your source code will be documented in the assignment handouts and announced in class.

We realize there are sometimes circumstances beyond your control that may prevent you from handing in your assignments on time, so we will allow a total of four (4) grace "late days" to use on the homework assignments as you need. For example, you may submit two homework assignments up to 2 days after their due dates, or a single assignment up to 4 days after the due date without penalty. Late assignments submitted beyond the allowed grace days will not receive credit (but must still be completed to pass the course).

Each project team will be expected to give a live demonstration of their final project to the teaching staff at the scheduled end-of-quarter project showcase. Please bring your haptic device (which we will collect from you at the end of the session) and anything else you need to show off your project. **No late course projects will be accepted, so keep your project scope manageable!**