Computer Graphics I - Fundamentals of Computer Graphics (CS171)

Fall, 2021
Time: Mon/Wed 13:00-14:40
Location: SIST 2-215

Introduction

When we talk about computer graphics, we usually mean visual things that are created by computer programs. Computer graphics is a discipline of applied computer science which was originated in 1960s and popularized from 1990s. It has been widely applied from computer aided design (CAD) and engineering (CAE), architecture, entertainment (e.g., gaming and movie industries), visual arts, to virtual and augmented reality, scientific and information visualization, medicine, robotics, as well as visual navigation and communication, etc. After the development for the past several decades, computer graphics has gradually been mature and integrated in many aspects of our life, and is evolving into an area of computer science which involves multiple disciplines, such as mathematics, physics, parallel computing as well as chip techniques such as graphics processing unit (GPU).

This course is an undergraduate course which provides the fundamental introduction to computer graphics as well as some of the advanced computer graphics techniques. Starting from the basic 2D computer graphics, the course mainly focuses on 3D computer graphics: camera modeling, projection, geometrical representation, modeling and transformation, graphical rendering with OpenGL and ray tracing, global illumination, sampling and anti-aliasing, computational imaging, scientific visualization as well as computer animation. The students will try to learn the basic algorithms in computer graphics, the programming skills for producing 3D images, as well as creating graphical animations, both non-physically-based and physically-based. In order to achieve these goals, the students need to finish assignments and projects, which are designed to be practical from easy to more difficult ones.

Prerequisites:

Programming (C/C++), Mathematics (Calculus, Linear Algebra, Probability), Data Structures and Algorithms

Note: If you are not good at mathematics and programming with C/C++, please think more carefully before you finally decide to choose this course.

Course Instructors

Xiaopei Liu: liuxp@shanghaitech.edu.cn; office hour: Mon/Wed 16:00~17:00; address: SIST Building 2, Rm 202.J

Teaching Assistants

Hongtu Xu: xuht1@shanghaitech.edu.cn; office hour: Thu 17:30~18:30; address: SIST Building 2, Rm 213

Mengyun Liu: liumy1@shanghaitech.edu.cn; office hour: Wed 17:00~18:00; address: SIST Building 2, Rm 213

Contents

Piazza

http://piazza.com/shanghaitech.edu.cn/fall2021/cs17101/

Course Materials

Reference book: Computer Graphics - Principles and Practice (but we will not follow this book)
OpenGL documents and tutorials: tutorial web, specification, shading language, and programming guide
Volume Rendering: Real-Time Volume Graphics
Rigid body simulation: SIGGRAPH Course I & II

Assignments

Warm-up: Programming Simple Graphics Program with OpenGL
Assignment1: Exploring OpenGL Programming
Assignment2: Geometric Modeling
Assignment3: Ray Tracing with Direct Lighting
Assignment4: Realistic Rendering with Global Illumination
Assignment5: Rigid body simulation

Grading

Programming assignments (55%): The students will complete five programming assignments. Each assignment will take scores based on their difficulties (specified in detail in their corresponding assignment documents).
Paper presentation (5%): The students will present research papers in groups with a Q&A session, which will be evaluated by the lecturer and the TAs.
Written examination (15%): There will be a written mid-term exam for the course (10%), which will cover the basic knowledge of computer graphics, with mathematical calculations, as well as five quizzes (5%)
Final project (25%): The final exam will be project-based, which will include an accomplishment of a group-based project (18%) as well as a formal presentation (5%) together with a technical report (2%).

Late hand-in policy: Each student is allotted a total of five late-day points for the *whole semester*, which work as follows:

- A student can extend a programming assignment deadline by one day using one point.
- If a student does not have remaining late-day points, late hand-ins will deduce 10% of the entire score of the corresponding assignment per day.
- No assignments will be accepted more than five days after the deadline. This is true whether or not the student has late-day points remaining.
- We will strictly follow the rule above for late-hand-in policy unless you have a **VERY STRONG** reason, which should be explained to the course instructor and TAs.

Collaboration Policy

Students in this course are absolutely encouraged to talk to each other, to the TAs, to the instructor, or to anyone else about course assignments. Any assistance, though, must be limited to the discussion of the problems and sketching general approaches to a solution. Each student should write their own code and technical report **independently**. Consulting another student's solution is prohibited and submitted solutions may not be copied from any source, including any code discovered online. These and any other form of collaboration on assignments constitute cheating. If you have any question about whether some activity would constitute cheating, just be cautious and ask the instructor before proceeding! Note that we will seriously treat plagiarism in this course!
