Computer Graphics

by Ruen-Rone Lee
ICL/ITRI

About the Course

What are the Purposes of this Course

Course Coverage

What will you learn from this course

Who should attend

Reference Books and Supplementary Studies

Grading

Course Information

- **Course ID: CS 550000**
- **Course title:**

  Computer Graphics
- **Classroom: 台達館璟德廳**
- **Class Schedule: WaWbWc**

Related Course

- ***Introduction to Graphics Programming and its Applications***
  - **Course ID: CS 450500, M7M8M9, 台達103**
  - **Lectured by Prof. Hung-Kuo Chu (朱宏國)**
  - **Focus on OpenGL programming, GLSL shader programming, and graphics applications**

Related Course

- *Advanced Computer Graphics*
  - Course ID: CS 650000, W7W8W9, 台達105
  - Lectured by Prof. Hung-Kuo Chu (朱宏國)
  - Focus on some hot research topics including *NPR*, *physical-based rendering*, *image-based rendering*, *modeling*, *shape deformation / manipulation*, and *applications in AR/VR*

What are the Graphics you know

- Games
  - PC games, console games, mobile games, …

Crytek
Warface

SEGA
Virtual Fighter 5

Halfbrick
Fruit Ninja

Rovio
Angry Birds Rio

What are the Graphics you know

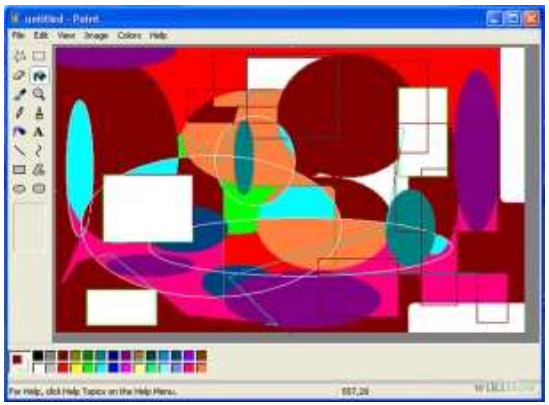
- **Movie Animations**
  - **Special effects, character design, …**

20th Century Fox
Avatar

Disney/Pixar
Monster University

What are the Graphics you know

- What else?
  - Adobe Photoshop?
  - AutoDesk 3D Studio Max / Maya?
  - Microsoft Paint?
  - …



Actually, any applications which involve *display processing* can be regarded as a kind of "*Graphics Processing*"

Where can you receive Graphics

- Any devices or facilities that equip with a display
  - Mobile phone
  - Tablet
  - TV
  - PC/Laptop display
  - Movie theater screen
  - Wearable devices
  - …

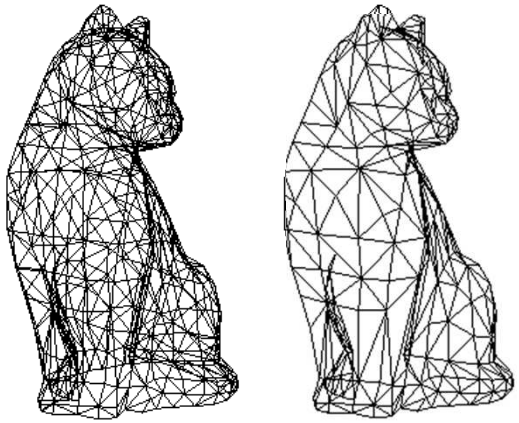






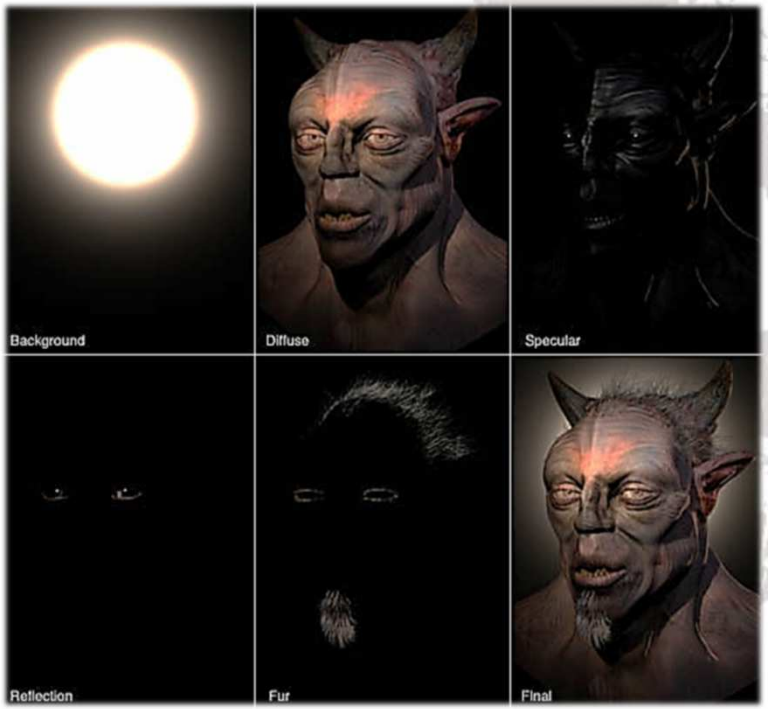
Who makes those Graphics

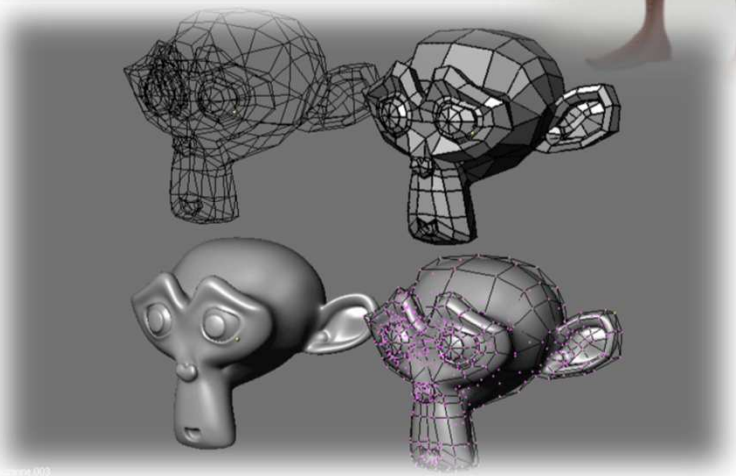
- Engineers
  - Software tools
  - Algorithms
  - Graphics hardware
  - Application programs
  - Visual effects
  - …



Who makes those Graphics

- Artists
  - Modeling
  - Animation
  - Lighting
  - …





What are the Purposes of this Course

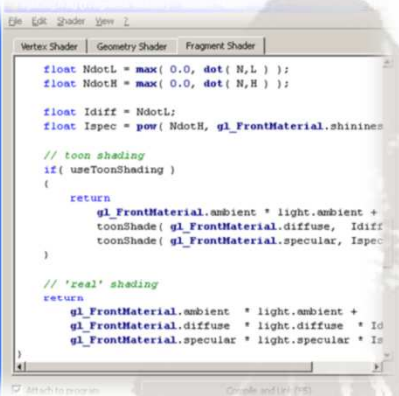
- **Know what computer graphics is dealing with**
- **Write some programs to manipulate some graphics tasks**
- **Generate some nice rendering results with various graphics techniques**
- **Get your interest in Computer Graphics**

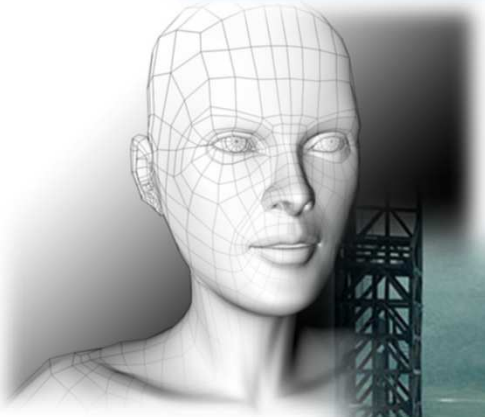
Course Coverage

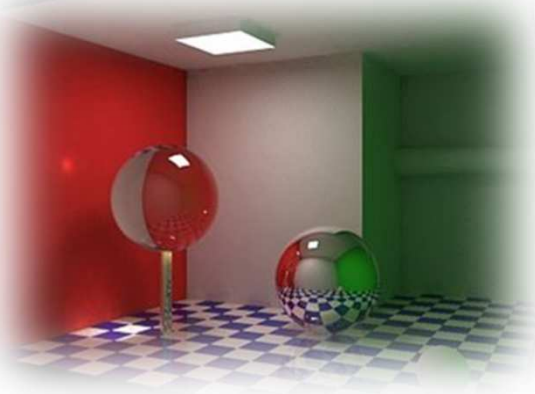
- **Part I: Basic Concepts**
  - Introducing the 3D Graphics
  - Geometric and Viewing Transformation
  - Lighting in 3D Graphics World
  - Adding Details with Texture Mapping

Course Coverage

- Part II: Advanced Graphics
  - Programmable Shaders
  - Modeling 3D Objects
  - Special Effects
  - Global Illumination
  - Animation
  - Performance Tuning

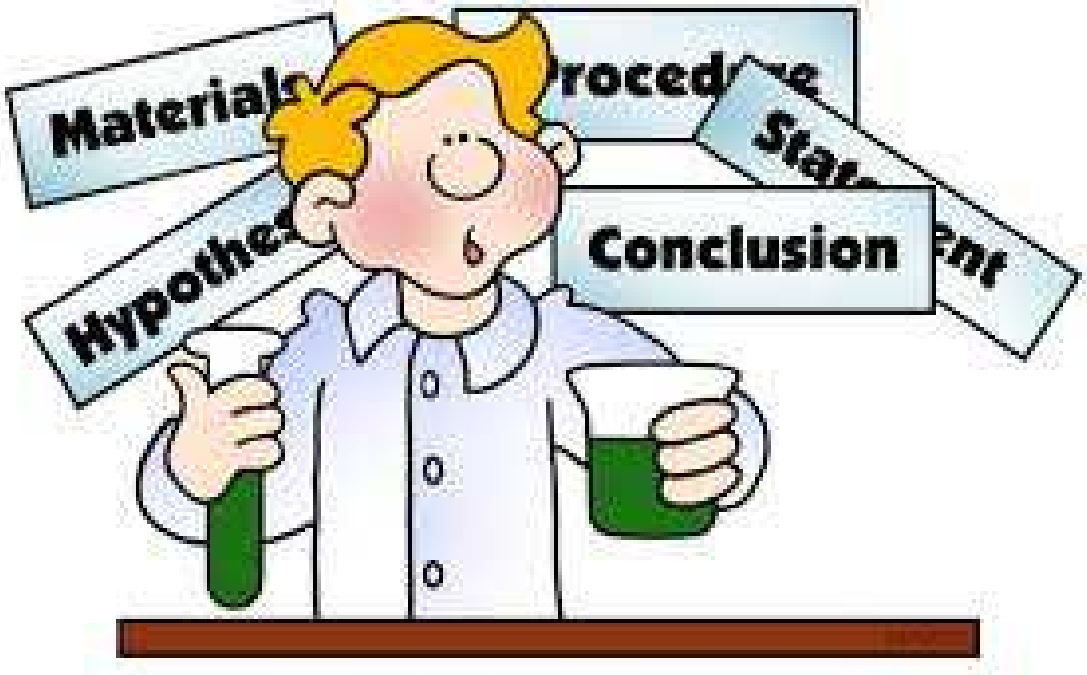






What will you learn from the Course

- Fundamental computer graphics?
  - Yes.
  - It is the key technique behind all the mentioned applications, including graphics hardware.



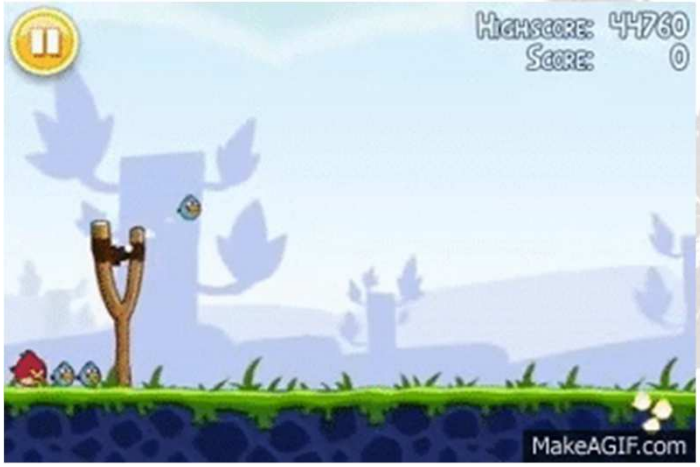
What will you learn from the Course

- Writing programs to render images by your own
  - Yes.
  - You should be able to render some nice images using OpenGL.

  - You can also try to write the programs on various platforms, such as PCs, Macs (iMac, Macbook), or some handheld devices (Android Phones, Apple iPhone or iPad using OpenGL ES).

What will you learn from the Course

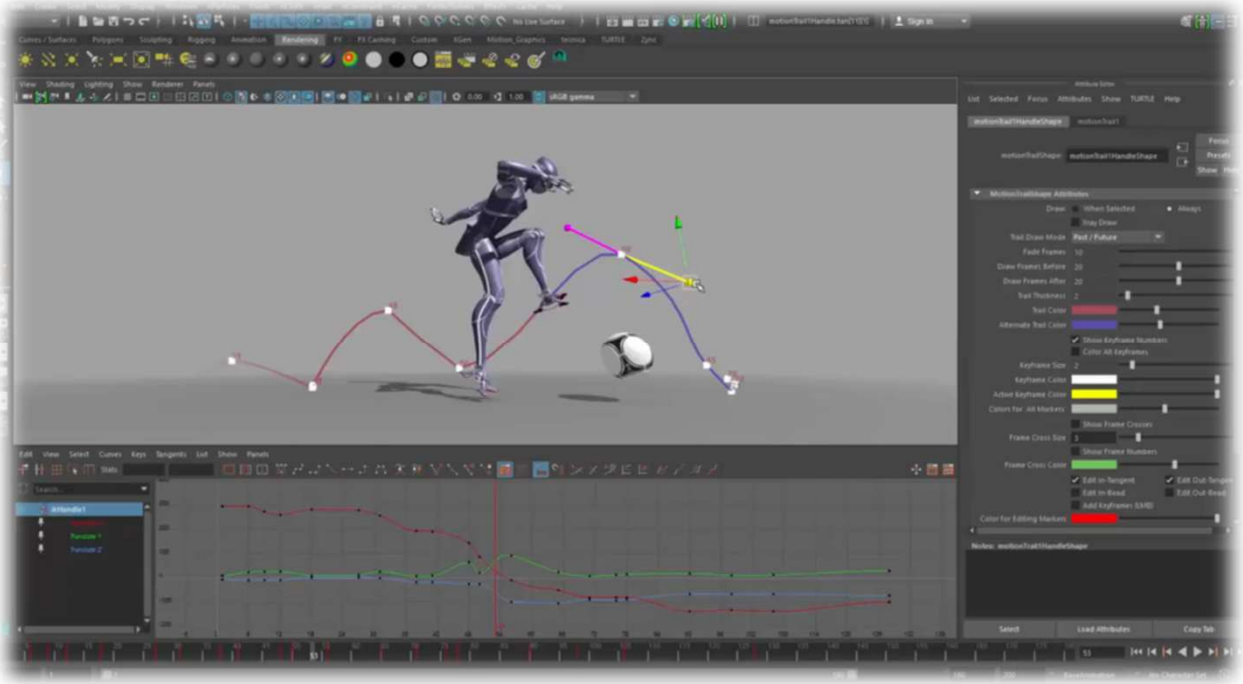
- Write some games like Angry Birds?
  - Not exactly.
  - Game design involve not only graphics but also game logic, audio, character and story design, billing system, …



  - But, we will cover some of the techniques used in the visual effects.
  - Recommend to take the course for game design using various game engines and tools
    - CS 550300 Introduction to Game Programming

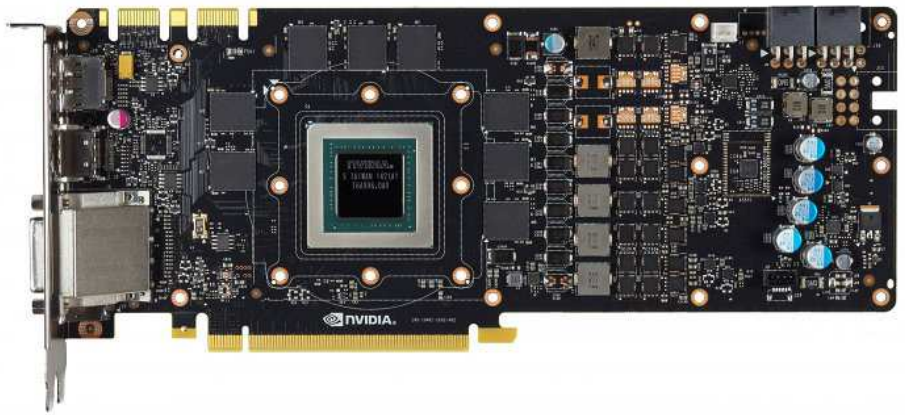
What will you learn from the Course

- Able to use Maya or other authoring tools in animation or modeling?
  - No.
  - We are not artists or animators. However, we should be able to create some tools for them.



What will you learn from the Course

- Design a graphics hardware?
  - No.
  - It needs more than just the knowledge of computer graphics.
  - However, you will learn how the graphics hardware works.



What will you learn from the Course

- Write efficient graphics programs?
  - Yes.
  - You should be able to know what are the tricks to run your graphics applications faster.
  - However, some of the topics will be left as an advanced course.

Who should Attend this Course

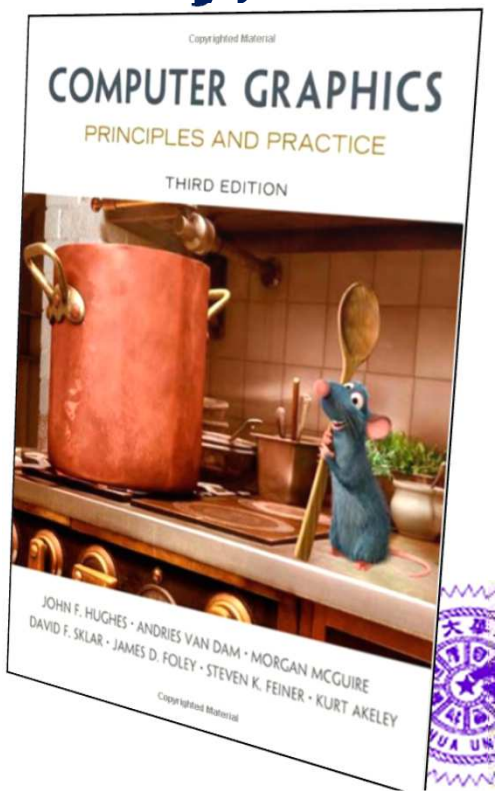
- The one who r ear d computer graphics befo
  - This course i aphics course to teach yo nics is and how to write som ons.
  - It is also are interest in writing game lications, and generating nic nation.

Text Book

- No text book is demanded
  - However, some of the reference books are recommended.
  - You should have at least one book in OpenGL programming for reference.

Text Book (recommended)

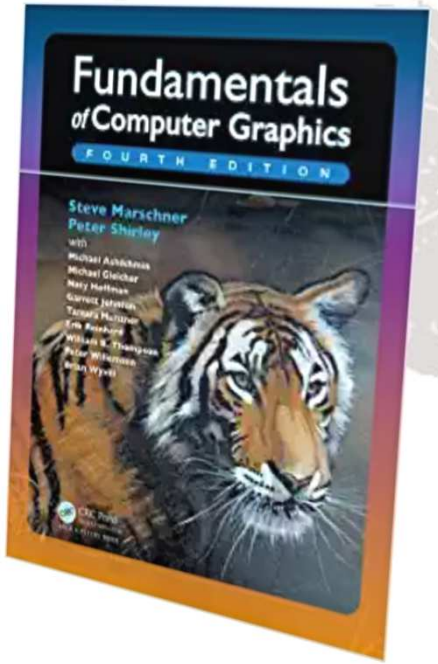
- ***Computer Graphics: Principles and Practice (3rd edition)***
  - **by John F. Hughes, Andries van Dam, Morgan McGuIre, David F. Sklar, James D. Foley, Steven K. Feiner, and Kurt Akeley. (2013)**



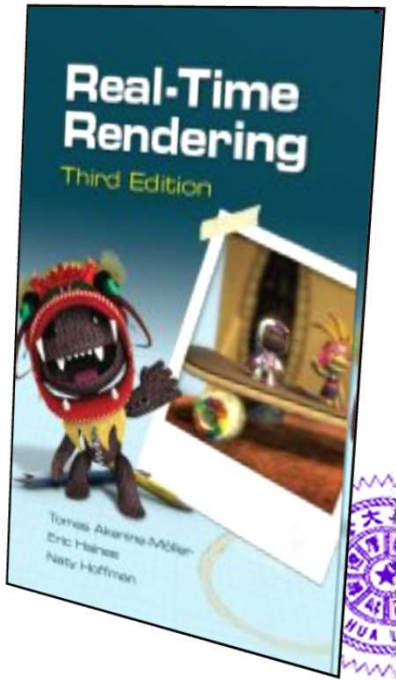
- **Cover most of the fundamental algorithms in 3D computer graphics**

Reference Books

- *Fundamentals of Computer Graphics, 4th edition*
  - by Steve Marschner and Peter Shirley, 2015.

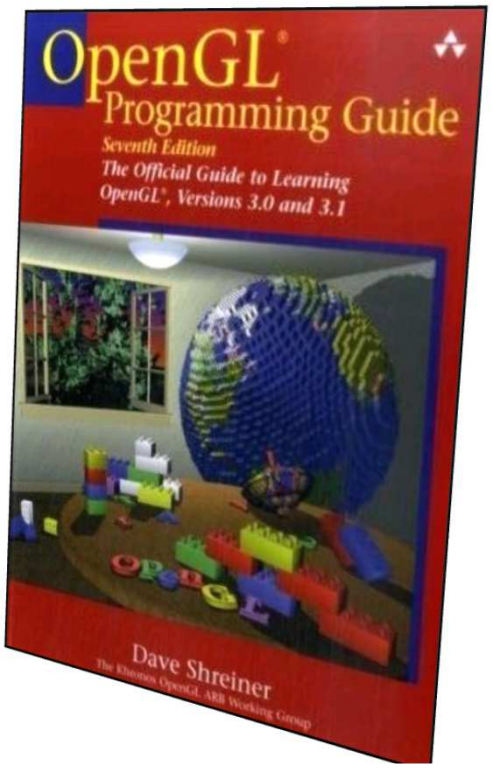


- *Real-Time Rendering, 3rd edition*
  - by Tomas Akenine-Möller, Eric Haines, and Naty Hoffman, 2008



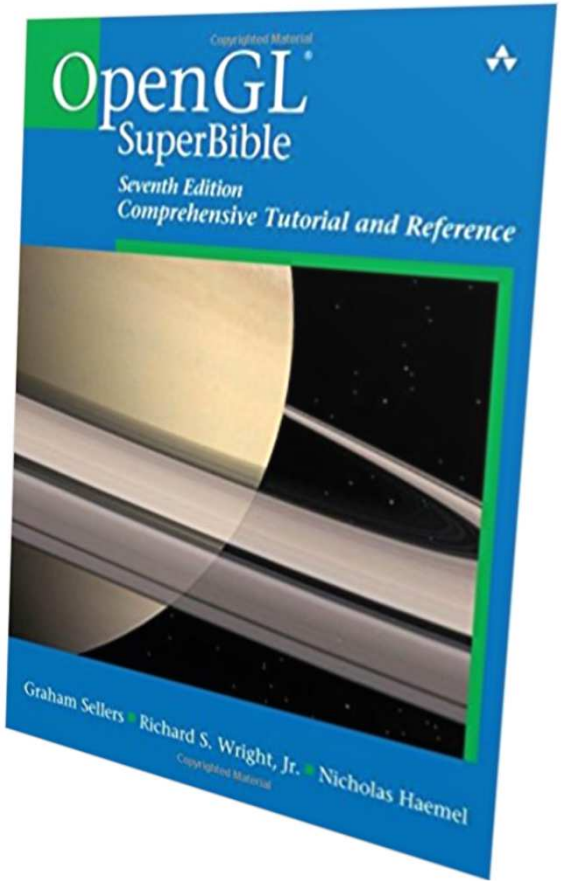
Reference Books

- ***OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 3.0 and 3.1, 7th Edition***
  - **by Dave Shreiner and the Khronos OpenGL ARB Working Group, 2009.**



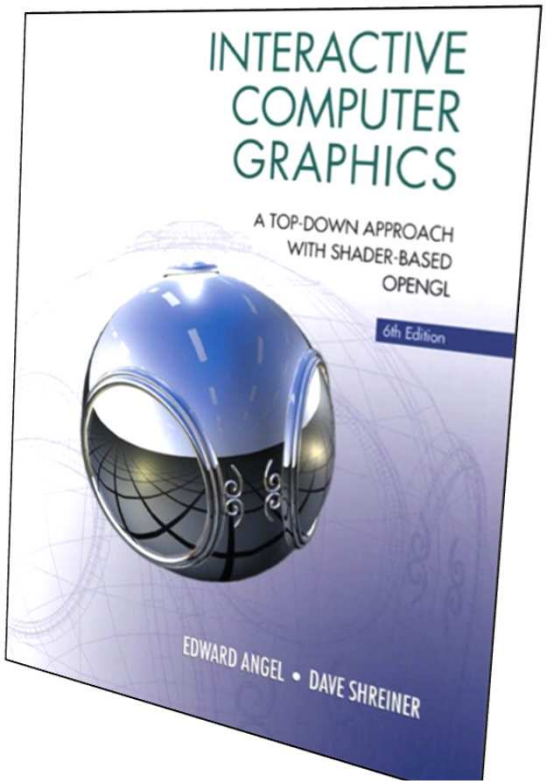
Reference Books

- *OpenGL Super Bible: Comprehensive Tutorial and Reference, 7th Edition*
  - by Graham Sellers and Richard S Wright Jr., 2015.



Reference Books

- ***Interactive Computer Graphics: A Top-Down Approach with Shade-based OpenGL (6th edition)***
  - **by Edward Angel and Dave Shreiner, 2011.**



Course Materials

- All the course notes, assignments, test models, and other related announcements, will be uploaded to the course webpage on iLMS
  - http://lms.nthu.edu.tw/course/33052
- Ask questions through iLMS
  - Fast response with 3 TAs and me… ☺
  - Reduce the answers with similar questions
  - Get extra bonus points

Pre-requisites

- Skill in C/C++ programming
  - All the assignments are in C/C++
  - Using Microsoft IDE
    - All the examples (Solution, project, …) are in VS2015
  - No Java, Python, html, …
- Skill in OpenGL programming (Optional)
  - All the assignments will be using OpenGL API
  - No OpenGLES, WebGL, Direct3D, …
- Linear Algebra
  - Vector space, matrix operations

Grading

- Assignments (90%)
  - 3~4 graphics programming assignments
  - Based on
    - Correctness and robustness
    - Examples and documentation
  - Submit your works through iLMS
  - Email submission will not be accepted
- Class participation (10%)

Teaching Assistants

- 陳勇安、張宏瑞、傅敬華
  - ext. 33531
  - Lab: Room 839, EECS building
- Responsibility
  - Questions regarding homework assignments
  - OpenGL programming issues
  - Any questions that you are afraid or feel shy to ask me
- Check for TA's availability before you go
  - E.g., demo your programs if required

Contact Information

- Ruen-Rone Lee (李潤容)
- Office: Room 107, Bldg. 9, ICL/ITRI
- Tel: (03)5912702 (ITRI office)
  - Email is preferred… ☺
- Email: rrlee@cs.nthu.edu.tw

Q&A

- Questions are always welcome and encouraged during class, break, or after class
  - Get immediately response
  - Or, post your questions (please be specific and clear) on iLMS
- TAs and me will be happy to answer your questions
  - You can also answer the questions if you know the answers and would like to share with others
  - Check the iLMS constantly for answers