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105**
- **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

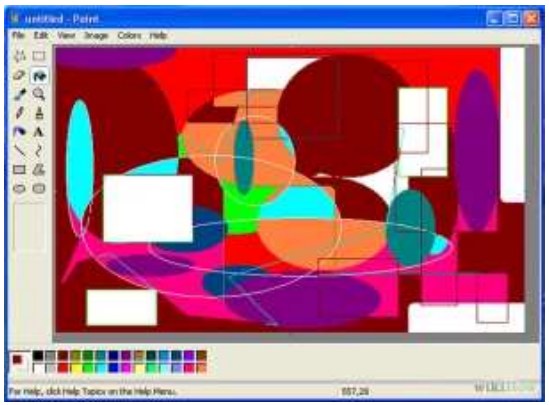
- **Movie Animations**
  - **Special effects, character design, …**

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
  - …

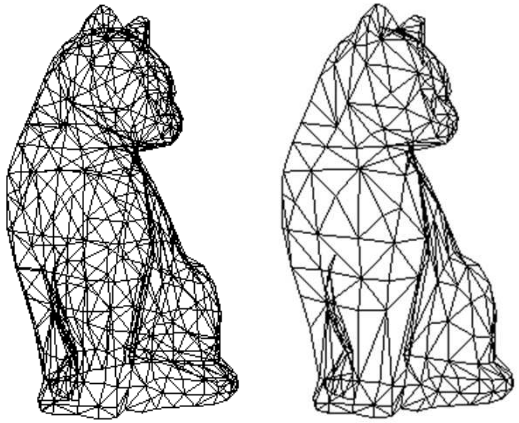






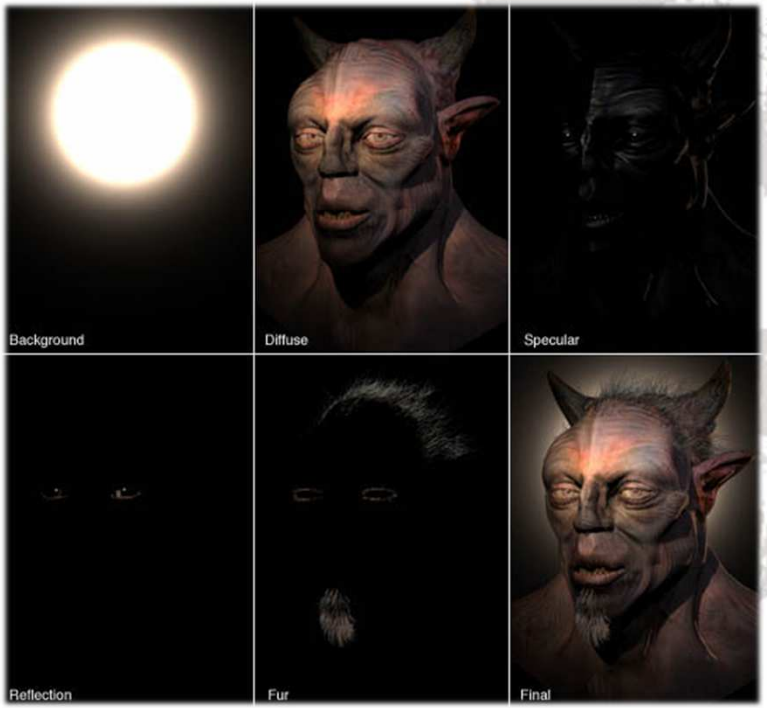
Who makes those Graphics

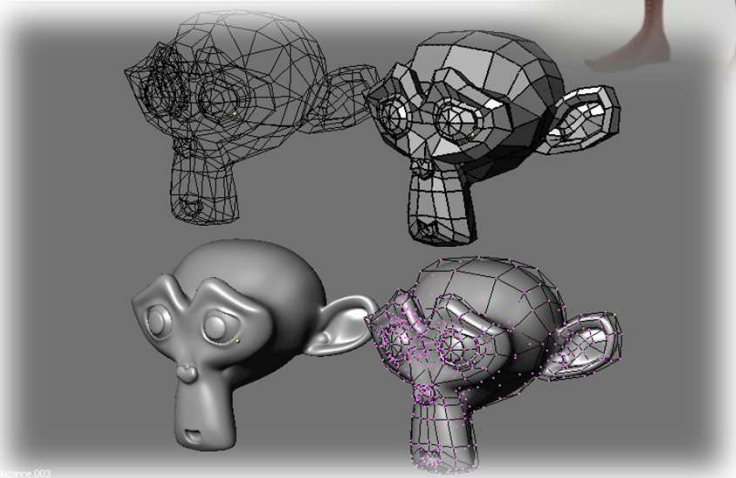
- Engineers
  - Software tools
  - Algorithms
  - Graphics hardware
  - Application programs
  - Visual effects
  - …

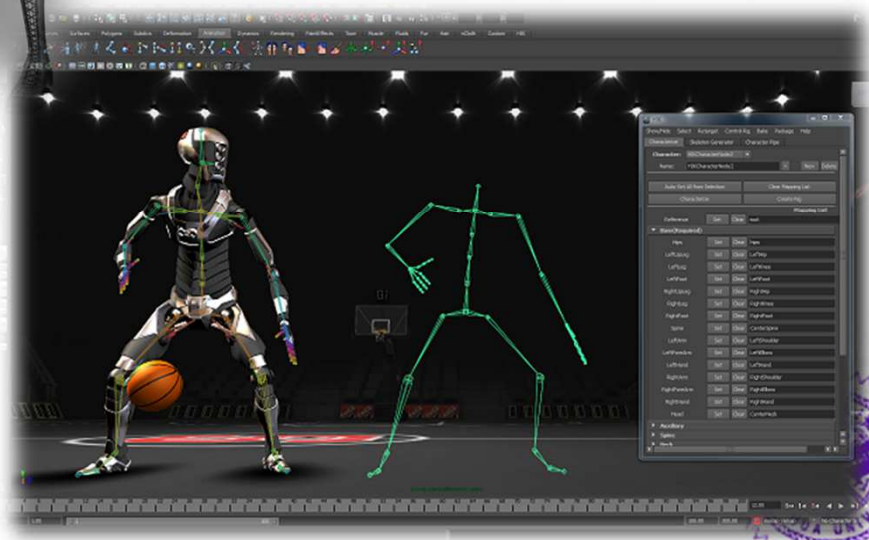


Who makes those Graphics

- 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, iPhone or iPad), or some handheld devices (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.**
  - **There is another course for game design using various game engines and tools.**

What will you learn from the Course

- Able to use Maya or other authoring tools in animation or modeling?
  - No.
  - We are engineers instead of art designers or animation directors. However, we should be able to write some tools for their use.

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

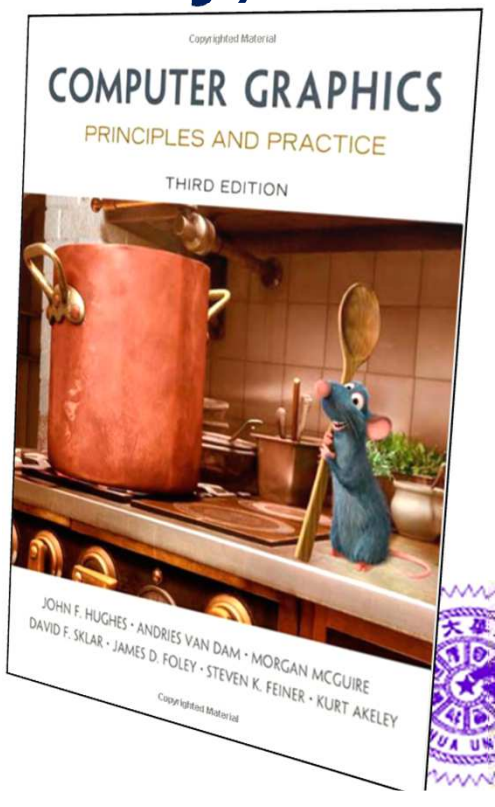
- **The one who never learned computer graphics before**
  - **This course is served as a basic graphics course to teach you what computer graphics is and how to write some graphics applications.**
  - **It is also designed for those who are interest in writing games, doing graphics applications, and generating nice image or animation.**

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.**

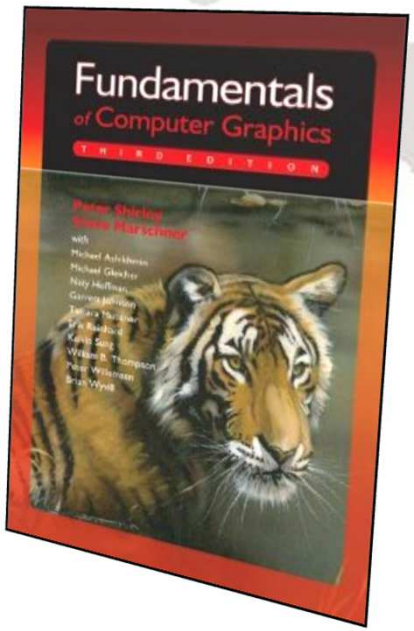
Text Book (recommended)

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

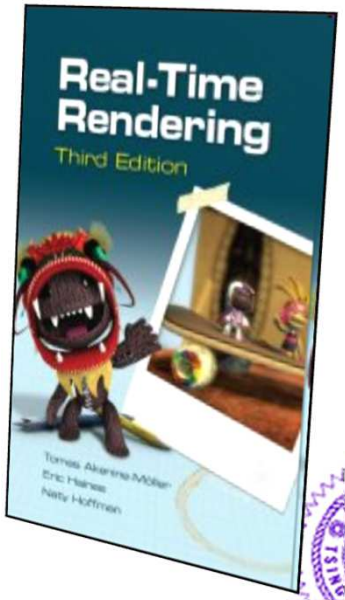


- **Cover most of the fundamental algorithms in 3D computer graphics**

Reference Books



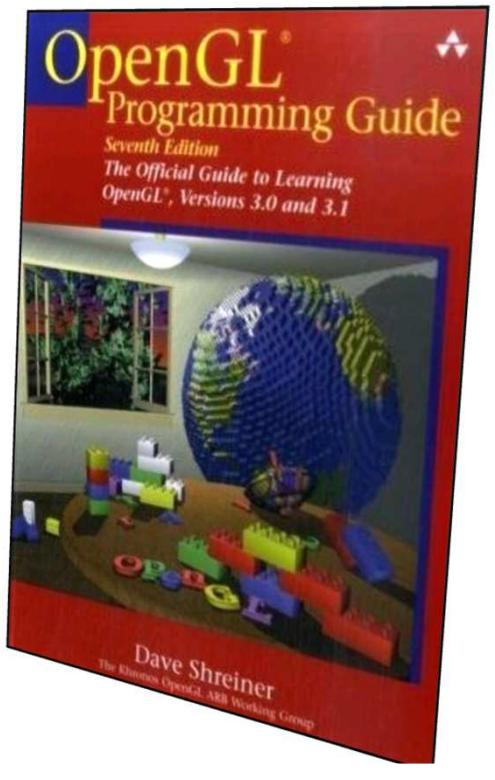
- ***Fundamentals of Computer Graphics, 3rd edition***
  - **by Peter Shirley and Steve Marschnes, 2009.**



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

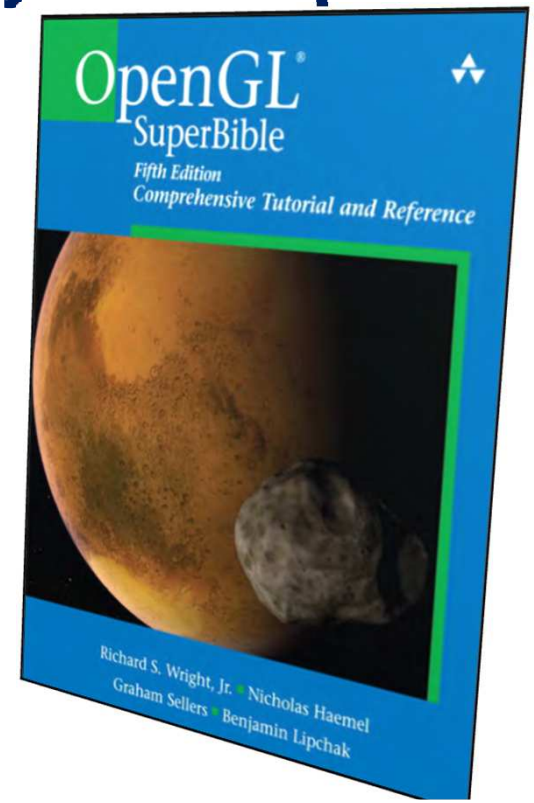
Reference Books

- ***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.**



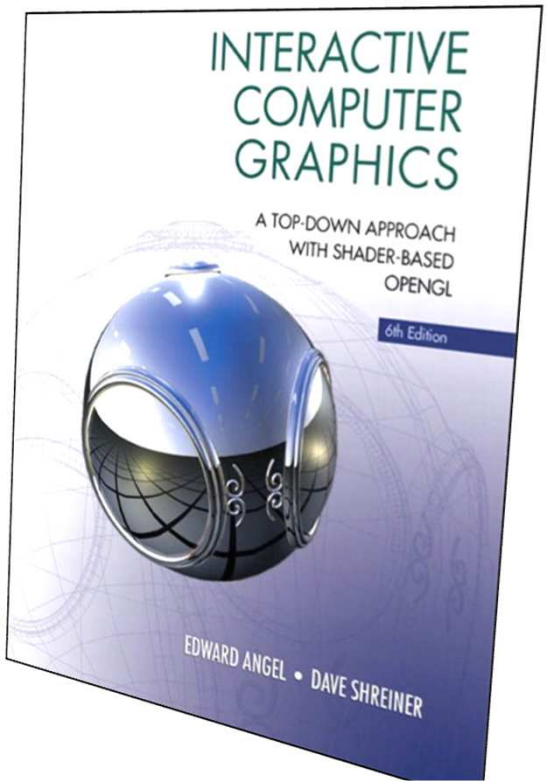
Reference Books

- ***OpenGL Super Bible: Comprehensive Tutorial and Reference, 5th Edition***
  - **by Richard S. Wright, Nicholas Haemel, Graham Sellers, and Benjamin Lipchak, 2010.**



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/28677
- 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**
- **Linear Algebra (optional)**
  - **Vector space**
  - **Matrix operations**

Grading

- Assignments (90%)
  - 3~4 graphics programming assignments
  - Grading based on
    - Correctness and robustness
    - Examples and documentation
- Class participation (10%)

Teaching Assistants

- 林文勝、田茂堯、蕭任宸
- **ext. 33531**
- **Lab: Room 839, EECS building**
- **Responsibility**
  - **Questions regarding homework assignments**
  - **Programming issues**
  - **Any questions that you are afraid or feel shy to ask me**

Contact Information

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- **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 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