Advanced GPU Programming 高級圖形處理器編程

The evolution of consumer graphics hardwares leads to the introduction of parallel, programmable GPUs (Graphics Processing Units). The strong parallel computational power of GPUs not only supports real-time and realistic rendering, but also the cost-effective platform for scientific computing, such as physical simulation, numerical analysis, evolutionary computation, image processing, and computer vision, etc. This course introduces the evolution of shading language and GPU, the basic concept in GPU programming and the recent advanced usage of GPU in computer graphics and general-purpose computing. Topics covered include: shader programming, procedural texture and modelling, programmable graphics pipeline, modern shading language, GPGPU (general-purpose computing in GPU), limitations of GPU, and case studies of advanced usages of GPU.

Grade Descriptor:

A
EXCELLENT – exceptionally good performance and far exceeding expectation in all or most of the course learning outcomes; demonstration of superior understanding of the subject matter, the ability to analyze problems and apply extensive knowledge, and skillful use of concepts and materials to derive proper solutions.

有關等級說明的資料，請參閱英文版本。

B
GOOD – good performance in all course learning outcomes and exceeding expectation in some of them; demonstration of good understanding of the subject matter and the ability to use proper concepts and materials to solve most of the problems encountered.

有關等級說明的資料，請參閱英文版本。
C

FAIR – adequate performance and meeting expectation in all course learning outcomes; demonstration of adequate understanding of the subject matter and the ability to solve simple problems.

D

MARGINAL – performance barely meets the expectation in the essential course learning outcomes; demonstration of partial understanding of the subject matter and the ability to solve simple problems.

F

FAILURE – performance does not meet the expectation in the essential course learning outcomes; demonstration of serious deficiencies and the need to retake the course.
**COURSE OUTCOMES**

**Learning Outcomes:**

At the end of the course of studies, students will have acquired the ability to
1. understand the design rationale of the hard-to-learn GPU programming.
2. understand how leading researchers in various fields making use of GPU for advanced research.
3. use GPU.

**Course Syllabus:**

The evolution of consumer graphics hardwares leads to the introduction of parallel, programmable GPUs (Graphics Processing Units). The strong parallel computational power of GPUs not only supports real-time and realistic rendering, but also the cost-effective platform for scientific computing, such as physical simulation, numerical analysis, evolutionary computation, image processing, and computer vision, etc. This course introduces the evolution of shading language and GPU, the basic concept in GPU programming and the recent advanced usage of GPU in computer graphics and general-purpose computing. Topics covered include: shader programming, procedural texture and modelling, programmable graphics pipeline, modern shading language, GPGPU (general-purpose computing in GPU), limitations of GPU, and case studies of advanced usages of GPU.

**Assessment Type:**

- Essay test or exam : 30%
- Others : 30%
- Presentation : 40%

**Feedback for Evaluation:**

1. Quiz and examinations
2. Course evaluation and questionnaire
3. Reflection of teachers
4. Question-and-answer sessions during class
5. Student consultation during office hours or online

**Required Readings:**

To be provided by course teacher.

**Recommended Readings:**

1. Anthony A. Apodaca & Larry Gritz, "Advanced RenderMan: Creating CGI for Motion Pictures", Morgan Kaufmann Publishers
(2000)
To keep the course materials updated, part of the lecture materials will also be compiled from the web or from difference sources.

OFFERINGS
1. CSCI5390  Acad Organization=CSEG; Acad Career=RPG

COMPONENTS
LEC : Size=30; Final Exam=Y; Contact=3
TUT : Size=30; Final Exam=N; Contact=1

ENROLMENT REQUIREMENTS
1. CSCI5390  Enrollment Requirement Group:
   For students in MSc Computer Science; or
   For students in MPhil-PhD Computer Science & Engineering; or
   For students in UG Computer Science; or
   For students in UG Computer Engineering;
   Prerequisite: CSCI2100 or ESTR2102 or CSCI2520 or equivalent

Additional Information
VTL-Onsite face-to-face hrs 0
VTL-Online synch. hrs 0
VTL-Online asynch. hrs 0