

# *ST: GPU Computing - Syllabus*

## **General Information:**

Course: CS 6/79995, Spring 2008

Call Number: 12456/12458

Time: Tuesday, Thursday 5:30 pm -6:45 pm

Room: MSB 276

## **Instructor:**

[Ye Zhao](#), Assistant Professor      Office: MSB 220 Email: [zhao@cs.kent.edu](mailto:zhao@cs.kent.edu)

Office Hours: Tuesday, Thursday 4:00 pm - 5:00 pm

## **Goal:**

The course is intended for anyone who has encountered a need for accelerated computing. The material and its presentation suit for a general audience from all academic disciplines.

## **Description:**

Recent research developments have impressively demonstrated that modern graphics hardware can be utilized for a much wider range of applications: from the computer games they were initially designed, to general purpose computing in physics, chemistry, biology, business and many other areas.

The truth of the matter is, the special effects of computer games and real-time home entertainment have become computationally so demanding and sophisticated that they now require a piece of hardware that almost resembles a "supercomputer on a chip", at commodity prices and plugged into commodity computing hosts - the PC. The speed of these graphics processors (or GPUs, for short) comes from the simplicity of their design. This enables high parallelism in the processing of the data, often allowing speedups of 1-2 orders of magnitude when compared to an equivalent CPU implementation. It has also allowed sustained performance growth rates at a triple of Moore's law. These developments have enabled exciting opportunities for numerical and scientific computing.

This course will first lay out the foundations of the underlying hardware. It will then illustrate how it is programmed, with both low-level and high-level constructs, using the C-language. The majority of the course will be dedicated to demonstrate the use of GPUs by ways of a wide variety of examples. This course will discuss some advanced concepts and methods in three dimensional computer graphics. The focus will be on learning recent methods in rendering, modeling, and animation.

## **Prerequisite:**

The only prerequisite is knowledge of a programming language, preferably C/C++.

No prior knowledge of computer graphics is required, but some mathematical background, such as linear algebra, is desirable.

## **Topics:**

Topics covered will include (may be changed):

Basics of computer graphics: concepts, pipeline, transformation, lighting

Overview of GPUs: architecture, features, programming model

System issues: cache and data management, languages and compilers, stream processing, GPU-CPU load balancing

GPU-specific implementations; may include 3D computer graphics topics, sorting and searching, linear algebra, signal processing, differential equations, numerical solvers

**Text:**

Unfortunately, no single textbook covers all the material of this course. We will make class notes and papers available instead. A required textbook is

R. Fernando and M. Kilgard, "The Cg Tutorial: The Definitive Guide to Programmable Real-Time Graphics", Addison-Wesley, 2003.

**Assessment:**

No paper examinations for the course.

Grading: Home works: 50%; Programming projects and presentations: 50%;

**Submission:**

All programs should conform to the submission standards given in URL  
<http://www.cs.kent.edu/~zhao/acg08/submission.htm>

**Notes:**

Home works and project submission deadlines are firm. There will be a penalty for late submission.

This syllabus and most subsequent information on the course will be available using the WWW. The home page for the course is: [www.cs.kent.edu/~zhao/gpu/index.htm](http://www.cs.kent.edu/~zhao/gpu/index.htm)

**Academic Integrity:**

All programs submitted must be your own work, and you are expected to develop your programs independently. You may receive as much help as you wish on the use of the operating system, text editors, debuggers, file transfer protocols and so on. You may consult with other members of the class about interpreting the projects, and you may get help in finding bugs, but not fixing bugs, but you are not allowed to look at or copy another person's code or discuss design decisions with others, and you cannot show your code to others. Students found to be in violation of these guidelines will fail the project, and will be reported to the dean.

**Students with Disabilities:**

University policy 3342-3-18 requires that students with disabilities be provided reasonable accommodations to ensure their equal access to course content. If you have a documented disability and require accommodations, please contact the instructor at the beginning of the semester to make arrangements for necessary classroom adjustments. Please note, you must first verify your eligibility for these through Student Disability Services (contact 330-672-3391 or visit [www.kent.edu/sds](http://www.kent.edu/sds) for more information on registration procedures).