EE590 - Advanced Topics : Applied High-Performance GPU Computing

Winter 2017

Time: Thursdays from 6:00-9:50 PM in EEB 361

Instructor: Dr. Colin Reinhardt (colinrei@uw.edu)

Office Hours: TBD (will take poll of class preferences)

TA: Logan Adams (lsadams@uw.edu)

Office Hours: Tuesday 7:00-8:30pm; Sunday 3:00-4:00pm (may be canceled week to week pending travel)

Any additional hours can be setup via email if these do not work for you.

Course Overview:

There will be 10 lectures given in the EEB 361 computer lab. Hand-on programming exercises will be part of the weekly lecture. Also there will be 4 homework assignments which will consist of (a) readings, (b) coding. The remainder of the quarter will be focused on a final project which will be comprised of a fairly significant GPU code design and implementation on a topic approved by the course instructor, utilizing and applying techniques learned in the class.

Grading:

- Homeworks (4) 50%
- Final Project 50%

Course Materials:

There is no required textbook for this course.

Reading materials for the course as well as a list of supplementary reading materials will be posted on the course website. Nearly all materials will be available in online electronic formats, either freely available public literature or through UW Library (www.lib.washington.edu)

Prerequisites

- proficiency programming with C and/or C++ programming and software development
    - The standard template library (STL) will be used.
- familiarity with vector calculus and partial differential equations (PDEs); physical foundations and formulation of PDEs, particularly the Maxwell's Eqns, the wave equation, and the dispersion equation.
- comfort with applied matrix analysis and linear algebra and numerical analysis, eigensystems, eigenvalue problems and solutions

Course Policies

You may collaborate and discuss homework assignments and project design and implementation with your fellow classmates, professor, TA and others. However, the work you submit must be your own, and you must write your own code(s). Copying code and plagiarizing is not allowed.

Course Schedule: Lecture Topics & Assignments

Week 1 : Introduction, evolution, and overview of parallel computing. Introduction and overview to OpenCL.

Week 2 : OpenCL host and kernel programming details. Code analysis, profiling, debugging.

- Homework-1 DUE : 12 JAN, 6 PM

Week 3 : OpenCL host and kernel programming details. Code analysis, profiling, debugging.

- Homework-2 DUE : 19 JAN, 6 PM

Week 4 : Parallel software and performance theory. Parallel patterns & algorithms, part 1.

- Homework-3 DUE : 26 JAN, 6 PM

Week 5 : Parallel patterns & algorithms, part 2.

- Homework-4 DUE : 2 FEB, 6 PM

Week 6 : Parallel FFT on GPU

- Final Project : Proposals DUE : 9 FEB, 6 PM

Week 7 : Case study in image processing with GPUs and OpenCL.

- Final Project : Design DUE : 15 FEB, 6 PM

Week 8 : Case study in machine learning with GPUs and OpenCL.

Week 9 : Case study in physics simulation and scientific visualization with GPUs and OpenCL.

Week 10 : Case study in FPGA programming with OpenCL.

- Final Project : DUE : 16 MAR, 11 PM