COMP 696: Advanced Parallel Computing (Fall, 2015)

Course Information:

- Instructor: Mary Thomas
- Meeting Time: Tues/Thurs @ 8:00 am
- Location: GMCS 408
- Office Hours: Tues/Thurs, 9:30 to 10:30 am

Course Description:

Students will learn to develop applications using parallel tools and concepts, including: libraries; numerical methodology; optimization tools; visualization of results; MPI and GPU computing models. Applications will be conducted on both the CSRC student cluster and NSF XSEDE computing resources.

COMP/CS 605 is hands-on, with weekly and semi-weekly programming assignments.

The course will consist of the following modules (based on Eijkhouts' book):

- Review of CPU/MPI programming concepts (1 Week)
- Review of GPU programming concepts (1 Week)
- Basic tools: SVN, Makefiles, Compiling, Scripting (0.5 Weeks)
- Computer Arithmetic (0.5 Weeks)
- Parallel performance, optimization, analysis/tuning tools (1 Week)
- Scientific Data Formats: ASCII, binary, NetCDF, HDF (0.5 Weeks)
- Visualization tools: Excell, GnuPlot, Matlab, NCView (1 Week)
- Parallel differential equations (ODE, PDE) (3 Weeks)
- Parallel linear algebra (3 Weeks)
- Scientific Applications (2.5 Weeks)

Course Prerequisites:

- COMP 605 or CS 605, or equivalent parallel programming experience.
- In-depth knowledge of the following parallel programming models is required
  - The Message Passing Interface (MPI)
  - GPU/CUDA Programming
- Graduate standing in Computational Science, Computer Science, Engineering, or instructor's approval
- In-depth knowledge of Unix operating systems and the C programming language is required:
- Helpful: FORTRAN; OpenMPI and Pthreads; Computer Science 501, 520, 525, Computational Science 526.

Crash Policy:

- In accordance with SDSU enrollment guidelines (University Policies), enrolled students must attend the first two classes or they will be dropped.
- Crashers will be accepted if there is room.
- The crash list will be updated at each class. New names on the list will be entered at the bottom of the list.
- As seats become available in class, students on the crash list will be added based on your graduate standing (PhD, MS, undergrad) and units earned toward your SDSU degree on your SDSU transcript.
- Only units currently on your SDSU transcript that apply to your degree will be counted.
- Crashers need to turn in a copy (hard copy or electronic) of their SDSU transcript to demonstrate how many units they have accumulated.
- Students that have not turned in a transcript will be assumed to have zero units.
Course Attendance:

- Attendance on the first day of classes is required.
- Students who are on travel/unable to attend must have a valid excuse and must obtain permission from the instructor in advance. No more than 2 days will be granted.
- Attendance to all classes is required.

Grading Policy:

All assignments must be on time, or points will be lost (5% the first day, and 1%/day afterwards). Specific requirements for each assignment will be explained. Grading rubric sheets will be provided with the assignment, and are subject to changes based on the project. Grades will be based on several factors, including:

- timeliness
- attendance & participation in class
- status of working code
- quality of project write-up, presentations, reports, etc.

Grades will be based on completion of all assignments and exams (TBD, depending on class progress). Approximate weighting of class work is shown below:

- 6-8 Homework assignments: 70%
- Two exams: 30%

This is a course that counts towards graduate degrees, and cannot be taken on a "Credit/NoCredit" basis.

Useful Course Links:

All email discussions and announcements will use your Blackboard email: make sure you are getting these announcements. We will have two types of mailing lists:

- **Blackboard** (used for general announcements including grade postings): [http://blackboard.sdsu.edu](http://blackboard.sdsu.edu)
- **Class mailing list**: We will use a separate SDSU mail server, which will be used for class discussion. Members of the class will be allowed to post questions, comments, information. You will be added to that list once you are confirmed to be in the course.
- **SDSU Final Exam Schedule**: [http://arweb.sdsu.edu/es/registrar/finalexams/](http://arweb.sdsu.edu/es/registrar/finalexams/)

Recommended Textbooks:

- **Course Textbook**: Introduction to High-Performance Scientific Computing, by Victor Eijkhout.
- **GPU/CUDA Programming**: [CUDA By Example, by Sanders and Kandrot](http://www.gpuguides.com/cudaByExample.html) [gzip file]