Professor: Torgersen  
Office Phone: 758-5536  
Office Hours: Monday, Wednesday, Friday 2:00 to 4:00. Also by appointment.  

Facilities: Dell PowerEdge C6146 (bally), Sun 5120 (genesis), WFU Linux Cluster (deac), LittleFE, possibly SGI Origin 2000 (kokua)

Goals:

1. Overview of Parallel Computing Paradigms
   (a) Speedup, Amdahl’s Law and Gustafson’s Law
   (b) Fine grain vs coarse grain parallelism
   (c) Data parallelism vs functional parallelism
   (d) Light weight threads
   (e) Shared memory parallel programming directives (e.g., OpenMP)
   (f) Message passing (MPI)

2. Overview of Parallel Architecture Designs
   (a) Pipelining and super-scalar instructions
   (b) Shared memory and memory issues, (e.g., contention, cache coherence)
   (c) Memory Coherency models
   (d) Message passing and communication issues
   (e) Traditional interconnect topologies
   (f) Multi-core processors (e.g., SPARC T2, AMD Bulldozer)
   (g) Vector processors (e.g., IBM G5/Altivec)

3. Theory: Parallel time complexity
   (a) Speedup
   (b) Scalability: Asymptotic relation between problem size and number of processors.
   (c) Parallel time
   (d) Efficiency: Ratio of Speedup to number of processors

4. Hands-on
   (a) Parallel programming projects.
   (b) Include problems from a variety of disciplines, e.g., image processing, problems from your thesis research.
   (c) Develop skill in programming with concurrent threads.
   (d) Program correctness: you can’t verify a parallel program by testing!!

5. Some widely-studied parallel problems,
   (a) Parallel prefix
   (b) Matrix algorithms, e.g., QR factorization
   (c) Sorting (e.g., bitonic sort) and Searching
   (d) Graph algorithms
   (e) Parallel FFT (if time allows)
6. Data dependency analysis
7. Automatic detection of parallelism (as time allows)

Expectations:

1. Class participation.
2. Communicate if things get complicated.
3. Your best effort.

Grading:
Two exams (60%), a few take home problem sets (10%), as many programming projects as we can produce (30%).

Disability Notice:
If you have a disability that may require an accommodation for taking this course, then please contact the Learning Assistance Center (758-5929) within the first two weeks of the semester.

Pandemic Planning Notice:
The University has requested that faculty collect personal contact information as part of emergency planning and preparation. The information you provide is strictly confidential.