

**WESTERN CAROLINA UNIVERSITY**  
**Department of Mathematics**  
**and Computer Science**

**CS 493 Cluster Computing**

**Dr. Barry Wilkinson**

**Outline**

**Fall 2003**

**Monday/Wednesday/Friday 2:00 pm - 2:50 pm,**  
**Stillwell 302**

## Parallel Computing

**Parallel computing** is the use of multiple computers, or computers with multiple internal processors, to solve a problem at a greater computational speed than using a single computer. It also offers the opportunity to tackle larger problems, problems with more computational steps or more memory requirements.

## Cluster Computing

Cluster computing is a form of parallel computing in which the computing platform is a group of interconnected computers (a cluster). A cluster of ten PCs is being established within the Department of Mathematics and Computer Science solely for parallel computing.

## Outline

In this course, we will learn parallel computing techniques and algorithms, and have practical experiences writing parallel programs on a cluster of computers. We will concentrate upon the message-passing method of parallel computing and use the standard parallel computing environment called MPI (Message Passing Interface). Thread-based programming will also be outlined. In addition, the distributed shared memory (DSM) approach will be covered.

## Prerequisites

Good programming skills (at least CS 150, better with CS 151).

Will need to learn basics of C if not already known. Programming can be done in C or C++ (not Java with tools we will use).

## Course Text

*Parallel Programming: Techniques and Application Using Networked Workstations and Parallel Computers*, by B. Wilkinson and M. Allen, Prentice Hall Inc., 1999, ISBN 0-13-671710-1.

On-line notes are provided which are derived from the course text.

## For reference

*Beowulf Cluster Computing with Windows*, T. Sterling (ed.), The MIT Press, Cambridge Massachusetts, 2002, ISBN 0-262-69275-9,

*Beowulf Cluster Computing with Linux*, T. Sterling (ed.), The MIT Press, Cambridge Massachusetts, 2002.

## Home Pages

For course notes, assignments, announcements, etc.:

**<http://www.cs.wcu.edu/~abw/CS493/>**

***Please check before each class.***

For programming help:

**[http://www.cs.uncc.edu/par\\_prog/](http://www.cs.uncc.edu/par_prog/)**

# Course Contents

(See course slides/textbook for detailed description)

**Parallel computers:** architectural types, shared memory, message passing, interconnection networks, meshes, hypercubes, etc., potential for increased speed.

**Basic techniques:** embarrassingly parallel computations, partitioning and divide and conquer, pipelined computations, synchronous computations, load balancing and termination detection, shared memory programming.

**Algorithms and applications:** sorting algorithms, searching algorithms, numerical algorithms, image processing algorithms



## Assessment

- Class tests (2) 30%
- Assignments (4) 50%
- Final exam 20%

Read small print

The assessment and percentages may be modified.

All submitted assignments must be your own work. Copied work or work done by more than one person (unless specifically instructed) will not be accepted - at the very minimum, zero credit.

## Attendance

The university has general policy of attendance (see page 65 of undergraduate catalog) and attendance is expected. Attendance will be recorded.

If you miss classes, it can have a deleterious effect on your grade:

After 4 missed classes without good reason:

**2 marks off overall accumulated marks (out of 100) for each additional class missed.**

If you must miss class, see me beforehand to avoid losing marks.

## Instructor

Barry Wilkinson

Room: Stillwell 313A

Tele: (828) 227 3944

Email: wilkinson@email.wcu.edu

## Office Hours

Monday/Wednesday/Friday 1:00 pm - 2:00 pm

Monday/Wednesday 4:15 pm - 5:15 pm \*

\*Will leave at 4:30 pm if no one turns up

(or let me know beforehand if coming later)

Walk-in at other times ok if not busy.