

CS-4234 (CRN 91847) / CS-5234 (CRN 91862)
Parallel Computation / Advanced Parallel Computation
Fall 2009

Essential information.

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| Instructor | Dr. Adrian Sandu |
| • Phone | 231-2193 |
| • E-mail | sandu@cs.vt.edu |
| • Office | 2224 KW-II |
| • Office hours | Mon 2–3pm, 2201 CRC |

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| Teaching Assistant | Min Li |
| • E-mail | limin@vt.edu |
| • Office | 106 McBryde Hall |
| • Office hours | Mon 3:50–4:35 pm, Tue 12:25–1:10 pm, 106 McBryde |

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| Lecture | MWF 11:15am –12:05pm, 219 McBryde Hall |
| Web Page | http://www.cs.vt.edu/~asandu/Courses/CS4234/CS4234.html |
| Prerequisites | CS-3204 |
| Final Exam | Section 11M, 3:25pm–5:25pm, December 14, 2009 |

Textbook.

Ananth Grama, George Karypis, Vipin Kumar, and Anshul Gupta: *“Introduction to Parallel Computing,”*. 656 pages, ISBN 0201648652, Addison-Wesley, 2003.

Additional References.

- Michael J. Quinn: *“Parallel Programming in C with MPI and OpenMP”*. 529 pages, ISBN 0-07-282256-2, QA 76.73.C15Q55, McGraw Hill Higher Education, 2004.
- *“The MPI Standard”*, <http://www-unix.mcs.anl.gov/mpi/>.
- *“The MPI Tutorial”*, <http://www.llnl.gov/computing/tutorials/mpi/>.
- *“The MPI Complete Reference”*, <http://www.netlib.org/utk/papers/mpi-book/mpi-book.html>.
- Ian Foster, *“Designing and Building Parallel Programs”*, <http://www-unix.mcs.anl.gov/dbpp/>.

About the course.

Due to exceptional circumstances CS4234 and CS5234 will be taught together.

This class will introduce the fundamental concepts of parallel computing. Topics include a survey of parallel computer architectures, models of parallel computation, and interconnection networks; parallel algorithm development and analysis; programming paradigms and languages for parallel computation; example applications; performance measurement and evaluation. If time permits we will discuss additional topics as well.

Topics.

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| Weeks 1–2 | Introduction and motivation. Parallel architectures. Parallel programming models. |
| Weeks 3–6 | Message passing programming. The Message Passing Interface (MPI). |
| Weeks 7–8 | Principles of parallel algorithm design: tasks, dependency graphs, mappings. Decomposition techniques: embarrassingly parallel, data decomposition, pipelined computations, etc. |
| Week 9 | Analytical modeling of parallel programs. Performance metrics and parallel performance analysis. |
| Week 10 | Non-numerical Applications. Floyd’s algorithm. Sorting. |
| Weeks 11–12 | Numerical Applications. Matrix-vector and matrix-matrix multiplication, solving linear systems. |
| Weeks 13–15 | Shared Memory Programming. Race conditions. OpenMP and applications. |

Grading.

For students registered for CS4234 the grade will be based on:

25% Mid-term exam

25% Final exam

50% Homework (theoretical and programming assignments)

For students registered for CS5234 there will be extra homework and exam problems. In addition, students registered for CS5234 will have to do presentations in class on relevant topics; the presentation material will be agreed upon with the instructor. The grade will be based upon mid-term (20%), final (20%), homework (40%), and presentation (20%).

Disclaimer.

Some information given to you in class may supersede the information in this syllabus or in the web page.

Student Complaints and Academic Misconduct.

Students are expected to comply to the Honor Code. If you have any problems, the first step is to discuss with me directly.

Disabilities.

Please let me know if you have a disability which requires special arrangements.