CS–5234 (CRN 13534)
Advanced Parallel Computation
Spring 2024

Essential information.

Instructor  Prof. Adrian Sandu
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  • Office hours By appointment, https://virginiatech.zoom.us/my/asandu7

Teaching Assistants  Amit Subrahmanya
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  • Office  https://virginiatech.zoom.us/my/amitns, in person by appointment
  • Office hours  TBA

Lecture  Tue–Thu 11am–12:15pm, 277 Whittencore Hall (WHIT 277), 1185 Perry St.
Web Page  http://www.cs.vt.edu/~asandu/Courses/CS5234/CS5234.html
Prerequisites  CS–3204. Graduate standing or permission of the instructor.
Final Exam  Section 11T, May 4, 2024, 1:05pm-3:05am.

Textbook.


Additional References for Parallel Algorithms and Design.


• Prof. Jim Demmel’s CS267 lecture notes: https://sites.google.com/lbl.gov/cs267-spr2023

• Ian Foster, “Designing and Building Parallel Programs”, http://www-unix.mcs.anl.gov/dbpp

Additional Resources for Parallel Programming.

- “The OpenMP Specifications”.
- “Introduction to OpenMP”.
- “MPICH implementation”, http://www.mpich.org
- “OpenMPI implementation”, https://www.open-mpi.org

About the course.

This class discusses 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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<td>Weeks 2–3</td>
<td>Shared memory programming. Race conditions. OpenMP and applications.</td>
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<td>Weeks 4–7</td>
<td>Message passing programming. The Message Passing Interface (MPI) and applications.</td>
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<td>Weeks 8–9</td>
<td>Principles of parallel algorithm design: tasks, dependency graphs, mappings. Decomposition techniques: embarrassingly parallel, data decomposition, pipelined computations, etc.</td>
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<td>Week 10</td>
<td>Analytical modeling of parallel programs. Performance metrics and parallel performance analysis.</td>
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<td>Week 11</td>
<td>Non-numerical Applications. Graph traversal, sorting.</td>
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<td>Weeks 14–15</td>
<td>Additional topics: programming heterogeneous multi-core architectures like graphics processing units (GPUs)</td>
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**Grading.**

The grade will be based on homework projects and on in-class presentations related to the final project:

30% Final project;

70% Homework projects (theoretical and programming assignments).

**Disclaimer.**

Some information given to you in class may supersede the information in this syllabus or on 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 that requires special arrangements.