

ECE 4/6930-004

Fault Tolerance and Reliability in High-Performance Computing

Instructor: Dr. Jon C. Calhoun
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Office: Riggs 221-C

Class Location: WFIC 316

Meeting Times: Tuesday and Thursday 9:30 a.m. - 10:45 a.m.

Office Hours: Tuesday 11 a.m. -12 p.m. Additional office hours must be arranged via email.

Course Description (3 credit hours)

Survey of current fault tolerance and reliability issues on high-performance computing (HPC) systems. Topics covered include: taxonomy of failures and errors, checkpoint-restart, fault injection techniques, soft error detection schemes, and lossy compression. Through a combination of lectures and paper readings, the students will gain an understanding of current fault tolerance and reliability issues.

Prerequisites: ECE 3220 or ECE 3290. Recommended ECE 4730.

Course Objectives

At the successful completion of the course,

- Students will be able to classify failures and errors in HPC systems
- Students will analytically and empirically analyze error detection schemes
- Students will analytically and empirically explore recovery schemes
- Students will apply techniques covered to improve the reliability of an HPC application

Required Materials

Textbook: None

Internet connected laptop.

Course Management System

The Canvas© system will be used to make class announcements, turn in assignments, and provide students access to additional course materials (e.g. PowerPoint slides, assignments, gradebook, papers discussed).

Tentative Topical Outline

Faults, Errors, and Failures in HPC	2 weeks
Checkpoint Restart	4 weeks
Fault Injection Techniques	1 week
Soft Error Detection and Recovery	4 weeks
Lossy Compression and Approximate Computing	4 weeks

A per class outline is available on the course's Canvas page.

Grading**Scale:**

A: [90%, 100%]; B: [80%, 90%]; C: [70%, 80%]; D: [60%, 70%]; F: [0%, 60%]

Paper and Presentation Reviews:	10%
Homework:	15%
Paper Presentations:	25%
Discussion Participation:	10%
Final Exam:	
UG:	20%
G:	10%
Project (Team based):	
UG: no more than 4 students	20%
G: no more than 2 students	30%

Graduate student projects are expected to be more rigorous and are graded accordingly.

Paper Presentation

When presenting a paper in class, the student(s) will be responsible for making slides and facilitating discussion. The presentation should largely focus on the paper but may contain supplemental material. Presentation should focus on highlighting major ideas in a way to foster discussion. This is not just a restatement of the paper's ideas. Example discussion topics include:

- New ideas and techniques
- Comparisons with other papers
- Strengths of paper
- Shortcomings of paper
- How you would have done things differently

Paper Reviews

Each student will submit a paper review for all papers discussed in class prior to the paper being discussed in class. Reviews should address each of the following sections in no more than 3 sentences per section:

- Brief summary of the paper
- Strengths of the paper
- Shortcomings of the paper

- How would you improve on this work?
- A question or issue to raise for discussion

Presentation Critique

Each student will submit a critique for all papers discussed in class. Reviews should address each of the following sections in no more than 3 sentences per section:

- Positives of presentation and discussion
- How could the presentation and discussion be improved?

Other Assignments

Details of other assignments will be discussed in class.

Email Policy

To receive a response, emails must be sent from your Clemson University email address and must include the course number. Professor will respond within 24-hours during weekdays unless on travel.

Late Assignments

Late assignments will have 1 letter grade deducted for each day that they are late. Examples of excused absences include a death in the immediate family or personal conditions requiring hospitalization or emergency treatment. Personal illnesses such as colds, general fatigue, or general sickness are not typically excused. If you are unsure if your situation will be excused, contact the professor in a professional manner prior to or as soon as possible after the missed assignment.