



ECE 4/6740: Fault Tolerance and Reliability in High-Performance Computing

Section 001

FALL 2020

MEETING TIME: TR 9:30-10:45 AM

MEETING LOCATION: Lehotsky Hall 257

INSTRUCTOR(s): Dr. Jon C Calhoun; Riggs Hall 221-C; jonccal@clemson.edu; 864-656-2646

OFFICE HOURS AND PROCEDURES: Tuesday 11 a.m. -12 p.m. Additional office hours must be arranged via email. See canvas for the Zoom link used for office hours.

COURSE MODALITY: HYBRID

COURSE DESCRIPTION: Survey of current fault tolerance and reliability issues on high-performance computing (HPC) systems. Topics include taxonomy of failures and errors, checkpoint-restart, fault injection techniques, soft error detection schemes, and lossy compression. Preq: ECE 3220 or ECE 3290. ECE 4730 is recommended, but not required.

COURSE PREREQUISITES: ECE 3220 or ECE 3290. ECE 4730 is recommended, but not required.

STUDENT LEARNING OUTCOMES:

- 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

REQUIRED MATERIALS: Textbook: None. Internet connected laptop with a webcam, microphone, and speakers/headphones.

TOPICAL OUTLINE:

Faults, Errors, and Failures in HPC	2 weeks
Checkpoint Restart	4 weeks
Fault Injection Techniques	1 week

Updated: August 2020

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.

CLASS CANCELLATION POLICY: Class is cancelled if the instructor is more than 15 minutes late to class and there is no email message or Canvas post explaining otherwise.

COURSE MANAGEMENT SYSTEM: Canvas 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).

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

Paper and Presentation Reviews:		10%
Homework:		25%
Paper Presentations:		25%
Discussion Participation:		10%
Final Exam:	UG:	10%
	G:	5%
Project(Team based):	UG: no more than 4 students	20%
	G: no more than 2 students	25%

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

See the lecture slides and Canvas assignments for more details about each category.

EMAIL POLICY: To receive a response, emails must be sent from your Clemson University email address to the professor's @clemson.edu email and must include the course number in the subject line. The professor will respond within 24-hours during weekdays unless on travel.

ATTENDANCE POLICY:

1. This course is a hybrid class. The university will assign students a day of the week they are to come this class; on other days, they must attend online.
2. Physical attendance on days students are to come physically is not required but is strongly encouraged to provide extra opportunities for office hours and one-on-one help with class exercises.
3. If students are not physically in attendance, it is required that they connect online. If there are technical issues preventing a student attending, the student should inform the professor at their earliest convenience.
4. In the event class is canceled, check Canvas for any schedule modifications. Assignments turned in through Canvas will not be pushed back unless noted by the professor. Exams will be rescheduled for the next class period.
5. Email the professor to inform him of expected absences.

6. To maintain physical distancing, individuals arriving first to the classroom should sit farthest from the door. Similarly, at the conclusion of class, students closest to the door should leave first.
7. While on campus, face coverings are required in all buildings and classrooms. Face coverings are also required in outdoor spaces where physical distance cannot be guaranteed. If a student does not have a face covering or refuses to wear an approved face covering without valid documented accommodation, the instructor will ask the student to leave the academic space and may report the student's actions to the Office of Community & Ethical Standards as a violation of the Student Code of Conduct. If the student's actions disrupt the class to the extent that an immediate response is needed, the instructor may call the Clemson University Police Department at 656-2222.
8. Please note that the University may convert to a purely online mode at any time.

ACCESSIBILITY STATEMENT: Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to a class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848 or by emailing studentaccess@lists.clemson.edu. Students who receive Academic Access Letters are strongly encouraged to request, obtain, and present these to their instructors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information here: <http://www.clemson.edu/campus-life/campus-services/sds/>.

TITLE IX STATEMENT: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972.

SAFE CAMPUS: Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

- a. Ensure you are signed up for emergency alerts (<https://www.getrave.com/login/clemson>)
- b. Download the Rave Guardian app to your phone (<https://www.clemson.edu/cusafety/cupd/rave-guardian/>)
- c. Learn what you can do to prepare yourself in the event of an active threat (<http://www.clemson.edu/cusafety/EmergencyManagement/>)

ACADEMIC INTEGRITY: As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a 'high seminary of learning.' Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a

Updated: August 2020

Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately to charges of violations of academic integrity. Further information on Academic Integrity can be found in the [Undergraduate Announcements](#) and in the [Graduate School Policy Handbook](#).

COPYRIGHT STATEMENT: Materials in this course are copyrighted. They are intended for use only by students registered and enrolled in this course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act. Students should be reminded to refer to the Use of Copyrighted Materials and “Fair Use Guidelines” policy in on the Clemson University website for additional information: <https://clemson.libguides.com/copyright>.

MODIFICATION STATEMENT: The professor reserves the right to modify any aspect of the syllabus at any time during the semester for reasons including but not limited to COVID-related situations.