ISC 5314-01 VERIFICATION AND VALIDATION IN COMPUTATIONAL SCIENCE

Instructor

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Time and Place

Lectures	Tuesday	12:30pm-1:45pm	152 DSL
CompLab	Thursday	12:30pm-1:45pm	152 DSL

Office Hours

Tuesday and Thursday, 2pm-3pm, 484 DSL, or by appointment

Credit

3 semester hours

Prerequisites

PHZ 4151C, ISC 5315, or consent of the instructor; basic programming skills in either Fortran, C, and/or C++

Webpage

http://people.sc.fsu.edu/~tplewa/Teaching/ISC_5314/index.html

Textbooks

- online lecture and computational laboratory materials
- basic: W. L. Oberkampf C. J. Roy, *Verification and Validation in Scientific Computing* (CUP) ISBN-10: 0521113601
- optional: Knupp, P., & Salari, K., *Verification of Computer Codes in Computational Science and Engineering* (Chapman & Hall/CRC: Boca Raton) ISBN-10: 1584882646

Justification

Computer simulation is of critical importance in several engineering and basic science applications. Frequently it is the only way to study complex physics phenomena, design new or improve the existing engineering systems. Verification and validation is a centerpiece of modern computer code development environment and of critical importance for creating successful simulation tools.

Audience

Graduate students with interest in scientific computation, development, maintenance and application of computer codes to both basic physics and real world problems.

Objectives

At the end of the course, the student will be able to: (a) conduct reliable scientific computations, (b) use effective methods in code development and maintenance, (c) design large scale physics simulation; (d) conduct scientific problem analysis and identify its critical elements' (f) estimate errors of the computer model and offer strategies for improving it; (g) visualize and present simulation results in form suitable for publication in scientific literature.

Catalog Description

The course will cover both theory and practice of verification and validation in computational sciences. Students will learn basic terminology, procedures and practical methods used in software implementation verification and solution verification, use of exact and manufactured solutions, and elements of software quality assurance. Essential data analysis techniques will be introduced and a review of software development and maintenance tools will be given. Examples from physical sciences and engineering will be used to illustrate aspects of code validation including validation hierarchy, validation benchmarks, and uncertainty quantification and simulation code predictive capabilities. Computational laboratory will be an essential part of the course.

Main Topics

(a) elements of modern science: observation and experiments, theory, computations; (b) the role of scientific computations in engineering and basic physics applications; (c) accuracy verification of computer codes; (d) error estimation and error control in computer modeling; (e) code validation in engineering and basic physics applications; (f) sensitivity analysis; (g) code certification; (h) software quality engineering.

Grading

The course grade will be based on 2 mini-exams (up to 30% contribution toward the grade), final exam (40%), and one select computational project (30%).
The scale for the grade will be:
A (90-100%), A- (87-89%), B+ (83-86%), B (77-82%), B- (73-76%), C+ (69-72%), C (63-68%), C- (59-62%), D+ (55-58%), D (50-54%), and F (<50%).

Academic Honor Policy

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to ". . . be honest and truthful and . . . [to] strive for personal and institutional integrity at Florida State University." (Florida State University Academic Honor Policy, found at http://dof.fsu.edu/honorpolicy.htm.)

Americans with Disabilities Act

Students with disabilities needing academic accommodation should:
(1) register with and provide documentation to the Student Disability Resource Center; and
(2) bring a letter to the instructor indicating the need for accommodation and what type. This should be done during the first week of class.

This syllabus and other class materials are available in alternative format upon request.

For more information about services available to FSU students with disabilities, contact the:

Student Disability Resource Center
97 Woodward Avenue, South
108 Student Services Building
Florida State University
Tallahassee, FL 32306-4167
(850) 644-9566 (Voice)
(850) 644-8504 (TDD)
sdrc@admin.fsu.edu
http://www.disabilitycenter.fsu.edu/