Introduction to Computational Fluid Dynamics
EML 4722 Class #26033, Fall 2020, MWF, Period 7, 1:55 PM – 2:45 PM

Professor

Assistant Professor Sae Miller, Ph.D.
University of Florida Department of Mechanical and Aerospace Engineering
MAE-A 306, Gainesville, FL 32611, PO Box 116250
Preference - please contact through the canvas website https://ufl.instructure.com

Office Hours

M & W, 1:55 PM – 3:00 PM, MAE-A 306 via confirmed written appointment

Teaching Assistants

N/A

Course Objectives

This course introduces students to the general theories, numerical algorithms, and processes of computational fluid dynamics. The main objectives are to understand the pre-process that includes the definition of the problem and grid generation, the solver, and the post-process that includes analysis of the results. The students will learn to interpret computational fluid dynamics results and develop skepticism that is balanced by verification and validation techniques. Throughout the course concepts will be illustrated through the use of one popular commercial computational fluid dynamics computer program. The students will have fundamental knowledge of boundary conditions, grid generation, solvers, turbulence modelling, visualization, numerical methods, and a variety of special topics at the termination of the course.

Course Description

Course Catalogue: General theory, skepticism, and practice of computational fluid dynamics. Computational grids and generation, boundary conditions, fluid dynamics, numerical methods, visualization, turbulence modelling, and various special topics.
(Credits 3)

Course Pre-Requisites / Co-Requisites

- EAS 4101 (Aerodynamics) and/or EGN 3353C (Fluid Mechanics), or permission of professor.
- Prefer completion of EAS 4102 (Compressible Flow)

Recommended Textbooks

- Müller, J., `Essentials of Computational Fluid Dynamics," CRC Pressure, Taylor & Francis Group2016. ISBN: 978-1-4822-2730-7 (Paperback)
- Ferziger, J. H. and Peric, M., `Computational Methods for Fluid Dynamics,' Springer, 2002.
- Cummings, R. M., Mason, W. H., Morton, S. A., and McDaniel, D. R., `Applied Computational Aerodynamics,' Cambridge, University Press, 2015.
- Tannehill, J. C., Anderson, D. A., and Pletcher, R. H., `Computational Fluid Mechanics and Heater Transfer,' Taylor and Francis, 1997.
- Aref, H. and Balachandar, S., `A First Course in Computational Fluid Dynamics,' Cambridge: Cambridge University Press, 2017. doi:10.1017/9781316823736
- Anderson, J., `Computational Fluid Dynamics,' McGraw-Hill, 1995.
- Various handout material provided digitally by professor.

Materials, Software, and Supplies

- Software – GMSH, SU2, and Paraview (all free and open source). See course website for instructions to obtain software.
- Personal computer (PC) that supports Windows, MAC OSX, or Linux.

Attendance Policy

- It is required that students attend class.
- Required statement by the University of Florida: Excused absences are consistent with university policies in the undergraduate catalog

(https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.

Class Expectations

- The student is responsible for their education. The professor is the guide to their understanding of the field.

Collaboration

- Homework – Traditional homework problems that should be completed individually.
- Numerical Homework – Homework that uses CFD software and numerics to complete. Students can work together on these assignments. Assignments must be submitted individually.
- Project and Presentation – Students are encouraged to form and work in groups during the group project and presentation.

Policy on Deadlines

- Late submission of class material is not accepted.
- If a tragedy has occurred then instructor notifications are required. See https://care.dso.ufl.edu/instructor-notifications for details. Note that, "Professors have the right to accept or reject the notification."

Evaluation of Grades and Grading Policy

Homework

The purpose of homework is to learn and understand the material. Students who turn in fully completed homework will receive 100% credit. Partial solutions of the homework will be posted on the class website after the due date. Students are responsible for understanding the homework problems and solutions. Students will submit solutions of the homework problems only via the course website.

Group Project and Presentation

The students will select a CFD project and perform analysis. They will present the results in the form of a presentation in front of the class at the end of the semester. Please refer to the course website and in class instructions for specific requirements of the group project and presentation.

Grade Corrections

Corrections of grades should be submitted promptly within 3 business days of the grade posting in writing with a concise factual statement of why there has been an error.

Course Grade Evaluation Criteria

- The graded material will be weighted as 0.35 Traditional Homework, 0.35 Numerical Homework, and 0.30 Project.
- The final grade will be assigned on the straight scale: 4.00 (A) → [93.33, 100.00], 3.67 (A-) → [90.00 to 93.33), 3.33 (B+) → [86.67 to 90.00), 3.00 (B) → [83.33 to 86.67), 2.67 (B-) → [80.00 to 83.33), 2.33 (C+) → [76.67 to 80.00), 2.00 (C) → [73.33 to 76.67), 1.67 (C-) → [70.00 to 73.33), 1.33 (D+) → [66.67 to 70.00), 1.00 (D) → [63.33 to 66.67), 0.67 (D-) → [60.00 to 63.33), and 0.00 (E) → [00.00 to 60.00). Final grades are rounded to the nearest hundredths place before assignment.
- At the discretion of the professor, the final course grades will be curved and all students may receive higher grades.