CFD for Aerospace Applications

Course Outline

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Concordia University - MIAE

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Course Outline

Instructor

- Dr. Boutanios is a Concordia alumnus (Beng and MASc in mechanical engineering).
- Professional mechanical engineer with 25+ years of industrial and research experience.
- Specialized in Computational Fluid Dynamics (CFD) and High Performance Computing (HPC).
- Further specialized in multiphase flow (flow transporting droplets, bubbles, aerosols, solid particles, etc.).

Course Outline

Instructor

- PhD in CFD of flow laden with solid particles (drifting snow, sand dune erosion, sediment transport, etc.).
- Master of applied science in mechanical engineering on CFD analysis of in-flight icing.
- Bachelor of mechanical engineering (thermofluids and propulsion).

Course Outline

Teacher's Assistant

- Ms. Christina Kolokotronis is a Concordia graduate (Beng in mechanical engineering).
- She is currently enrolled in the MASc program in mechanical engineering working on a CFD thesis.
- Christina has taken AERO 455 during her Beng studies and is fully qualified to TA this course.
- Christina is experienced in opensource and commercial CFD software and pre/post-processors.

Course Outline

Objectives

- This course is meant to introduce undergraduate engineering students to CFD.
- In the first half we start with a review of fluid dynamics, namely the Navier-Stokes equations.
- Then we will study CFD theory in general, with emphasis on the finite volume method which is the industry workhorse.
- We will also spend a week on preparation work for CFD analysis, namely CAD and meshing.
  - This is called *pre-processing*.

Course Outline

Objectives

- In the second half we switch to an industry perspective by examining industry workflows and use cases.
- This is where you will put your newly acquired CFD skills to good use in the course projects.
- By the end of this course you will have acquired entry-level CFD skills as required for industry jobs.
- This will hopefully help you decide whether you want to pursue jobs in CFD or even deepen your knowledge of it with future research (master, PhD).

Course Outline

Grading Policy

- GOOD NEWS: no final exam!

Component	**Weight**
Assignments	15%
Labs	20%
Midterm	25%
Group Project	40%
Bonus Personal Projects	2 x 5%
Total	110/100

Course Outline

Grading Policy

- You need a minimum of 50% to pass the course.
- You need to pass every component, with the exception of the midterm which you can makeup for with bonus personal projects.
- The bonus personal projects can be used regardless of the midterm though.
- The only optional component is the bonus personal project.

Course Outline

Grading Policy

- **Assignments**,
  - We will have up to 7 assignments covering the lectures of weeks 1 to 9.
  - A minimum cumulative grade of 50% is required on the assignment component.

Course Outline

Grading Policy

- **Labs**,
  - We will have up to 7 labs covering the lectures of weeks 5 to 11.
  - They will be done in groups of about 5 students.
  - A minimum cumulative grade of 50% is required on the lab component.

Course Outline

Grading Policy

- **Midterm**,
  - The midterm will cover the theoretical component of the course (lectures of weeks 1 to 6).
  - It will be written in class or live online, subject to prevailing restrictions.
  - A minimum grade of 50% is required to pass the midterm.
  - Students who fail the midterm have the option to make it up with bonus personal projects.

Course Outline

Grading Policy

- **Term Project**,
  - The term project will be carried out in groups of roughly 5 students.
  - The students can choose the software stack to be used (CAD and meshing software, CFD solver, visualization software).
  - Project themes will be chosen and assigned after week 7.
  - Each team will submit a written report of 7500 to 12500 words of their findings.

Course Outline

Grading Policy

- **Term Project**,
  - Students can/should consult the instructor and the TA on the term projects.
  - Each team will present their project in a 20 minutes presentation in class or live online, and will answer questions by the instructor and classmates in a 10 minutes question period.
  - A degree of difficulty may be assigned to each project with respect to grading.

Course Outline

Grading Policy

- **Bonus Personal Projects**,
  - Each student has the possibility to do up to 2 personal projects on any theoretical or applied component of the course.
  - The student can choose the software stack to be used, if needed.
  - Personal project themes can be suggested by the student, to be approved by the instructor.

Course Outline

Grading Policy

- **Bonus Personal Projects**,
  - Students can consult the instructor and the TA on the personal projects.
  - The student will submit a written report of 2500 to 5000 words of their findings.
  - The student will present their findings in a 10 minutes presentation to the instructor and will answer questions by the instructor in a 5 minutes question period.