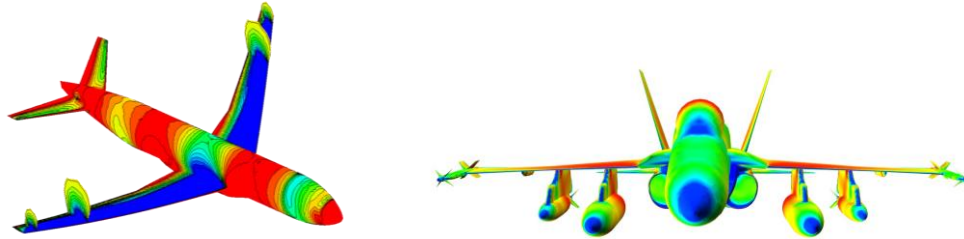


# AA 214: Numerical Methods for Compressible Flows

**Schedule:** Winter 26, M-W-F (2 of 3) 10:30 am – 11:50 am

**Units:** 3

**Venue :** Gates B3



## Course Description

This course is designed for M.S.-level students. It covers the hierarchy of mathematical models for compressible flows and an introduction to finite difference and finite volume methods for their computation.

## Course Outline

Computational Fluid Dynamics: What is it? Why? What for? — Hierarchy of Mathematical Models — Conservation — Integral Forms and Discontinuities — Linearization — Characteristic Relations — Representative Model Problems — The Finite Difference Method — The Finite Volume Method — Treatment of Boundary Conditions — Linear and Nonlinear Stability Analyses — Error Analysis — Local Time-Stepping and Dual Time-Stepping.

## Prerequisites

- Basic knowledge of linear algebra and ODEs (CME 206 or equivalent).

## Textbooks and Other Reading Materials

- Culbert B. Laney, Computational Gasdynamics, CAMBRIDGE UNIVERSITY PRESS, ISBN 0-521-62558-0.
- C. Hirsh, Numerical Computation of Internal and External Flows, Volume 1 and Volume 2, WILEY, ISBN 978-0-471-92385-5 (Volume 1) and ISBN 978-0-471-92452-4 (Volume 2).
- John D. Anderson, Jr., Computational Fluid Dynamics, *The Basics with Applications*, MC GRAW HILL, ISBN 0-07-001685-2.
- Lecture notes and various reading materials.

## Homeworks

- Assigned in general on a weekly basis.
- Subject to the Stanford Honor Code (no attempt to find and no consultation of any published solutions; collaboration with other students taking the course is allowed)

as long as it is limited to discussing the statement of the problem and how to proceed about solving it – everything else is an individual task).

### **Examination**

- 24-Hour Take Home Final Exam: **Released on 03/17/2026 at 10:00 am.**  
**Due on 03/18/2026 at 10:00 am.**
- Subject to the Stanford Honor Code (no attempt to find and no consultation of any published solutions; no assistance from anyone/anything).

### **Course Grade**

- Based 65% on the grades for the homework assignments.
- Based 35% on the grade for the Take Home Final Exam.
- To ensure fairness and facilitate timely posting of solutions and grading, homework assignments must be submitted on time to receive a grade. Additionally, the Take Home Final Exam will only be administered once, with the release and due dates clearly indicated above.

### **Instructor**

Charbel Farhat, Department of Aeronautics and Astronautics.  
William F. Durand Building, Room 257, 496 Lomita Mall, 94305.  
Telephone: (650) 723-3840; FAX: (650) 725-3525; e-mail: [cfarhat@stanford.edu](mailto:cfarhat@stanford.edu).

Office Hours: 1:00 pm – 2:00 pm on each lecture day and/or by appointment, Durand Building, Room 257.

### **Teaching Assistant**

Rodrigo Blanco Arce, Department of Aeronautics and Astronautics.  
William F. Durand Building, 496 Lomita Mall, 94305.  
E-mail: [roblanco@stanford.edu](mailto:roblanco@stanford.edu).

Office Hours: Tue 11:30 am – 1:00 pm, Fri 3:00 pm – 4:30 pm.  
Durand Building, Room 270.

### **Students with Documented Disabilities**

Students who may need an academic accommodation based on the impact of a disability must initiate the request with the Student Disability Resource Center (SDRC) located within the Office of Accessible Education (OAE). SDRC staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an *Accommodation Letter* for faculty dated in the current quarter in which the request is being made. Students should contact the SDRC as soon as possible since timely notice is needed to coordinate accommodations. The OAE is located at 563 Salvatierra Walk (phone: 723-1066).