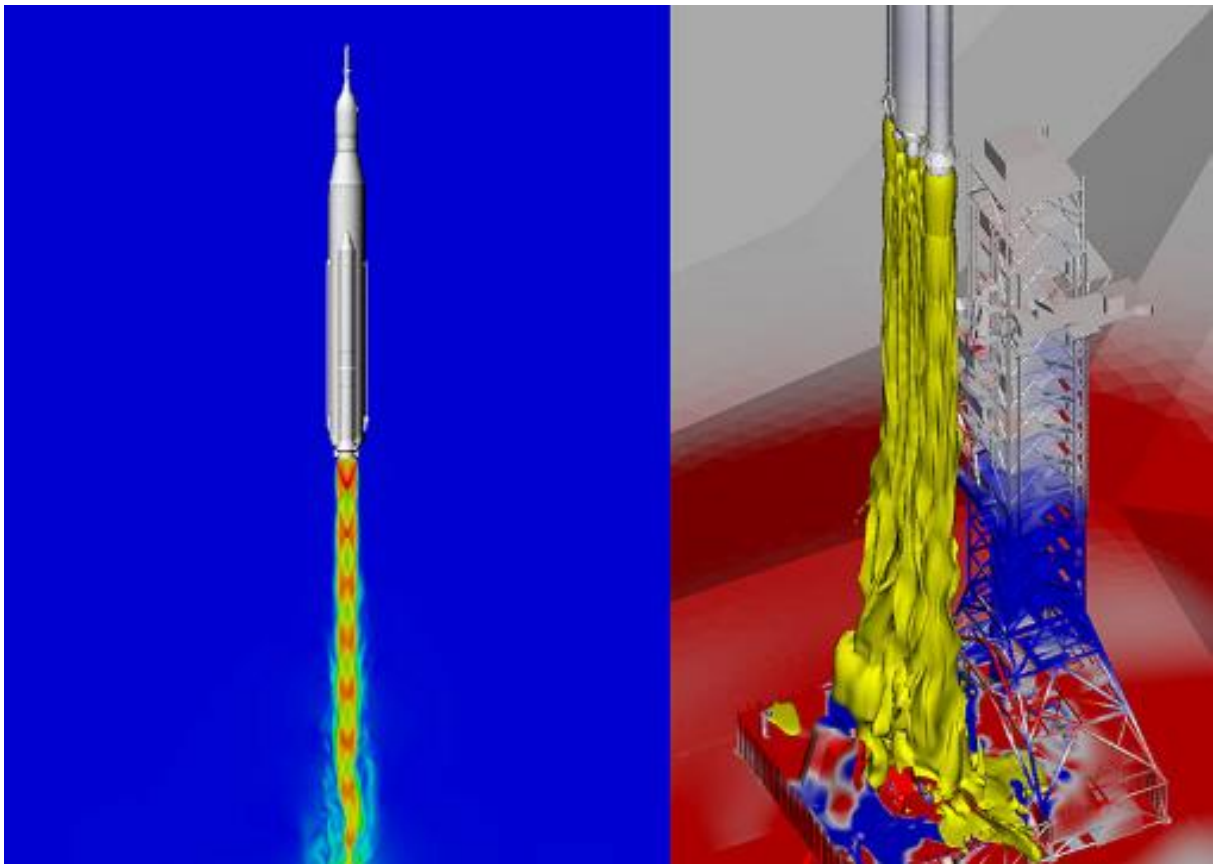
AE 169 – Computational Fluid Dynamics – Spring 2019



Instructor Info Dr. Periklis Papadopoulos
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Office Hours Wed 4:30 pm – 6:30 pm

Course Credit 3 units

Class Days / Time TR 10:30 – 11:45 am
Final Exam Wednesday 16 May 12:15 – 2:30 pm
Classroom Engr-331

Prerequisites "C-" or better in: Math 129A, AE160

Textbook *Fundamentals of Computational Fluid Dynamics*
Lomax, Pulliam and Zingg, Springer-Verlag, Berlin 2001
ISBN 3-540-41607-2

Description

Physical and mathematical foundations of computational fluid mechanics with emphasis on applications. Solution methods for advection, diffusion, Euler and Navier-Stokes equations. The finite-volume formulation of the equations. Classification of partial differential equations and solution techniques. Truncation errors and stability analysis.

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Goals Introduce students to basic numerical methods for fluid dynamics as well as to the basics of grid generation.

Learning Objectives

Students completing AE169 should be able to:

1. Use numerical tools based on the Euler and Navier-Stokes equations to analyze inviscid and viscous flows.
2. Generate appropriate grids for various aerospace engineering flows.
3. Determine the accuracy of numerical methods.
4. Use linear theory to design a numerical algorithm for a specific application.

Approximate Weekly Schedule

Week	Topic(s)
01	Introduction to computational fluid dynamics
02	Partial differential equations
03	Discretization methods; errors, stability and consistency
04	Explicit time differencing methods
05	Implicit time differencing methods
06	Central, upwind and characteristics of spatial differencing techniques
07	Classical relaxation methods
08	Multigrid methods
09	Numerical methods for inviscid flows
10	Shock-capturing methods
11	Numerical methods for boundary layer flows
12	Numerical methods for the Navier-Stokes equations
13	Modeling of 3-D aerodynamic flows
14	Grid generation; algebraic, differential equation, and variational methods
15	Grid generation; unstructured and adaptive grids
16	Contemporary methods and codes

Grading

Biweekly Quizzes	600 points
Project	200 points
Homework Problems	200 points

950 points	< A+
900 points	< A
850 points	< A-
800 points	< B+
750 points	< B
700 points	< B-
675 points	< C+
650 points	< C
625 points	< C-
600 points	< D
Below 600 points = F	

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Project

Work in assigned teams to define a CFD project relating to your aircraft or spacecraft design project. A proposal is due no later than the 3rd week of the semester following the posted guidelines. Progress reports are due every 2 weeks throughout the semester. A final report and an oral presentation are due at the end of the semester.

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus InfOrmation web page at http://www.stsu.edu/gup/syllabusinfO!

AE Department *and SJSU policies are also posted at*
http://www.sjsu.edu/ae/programs/policies/