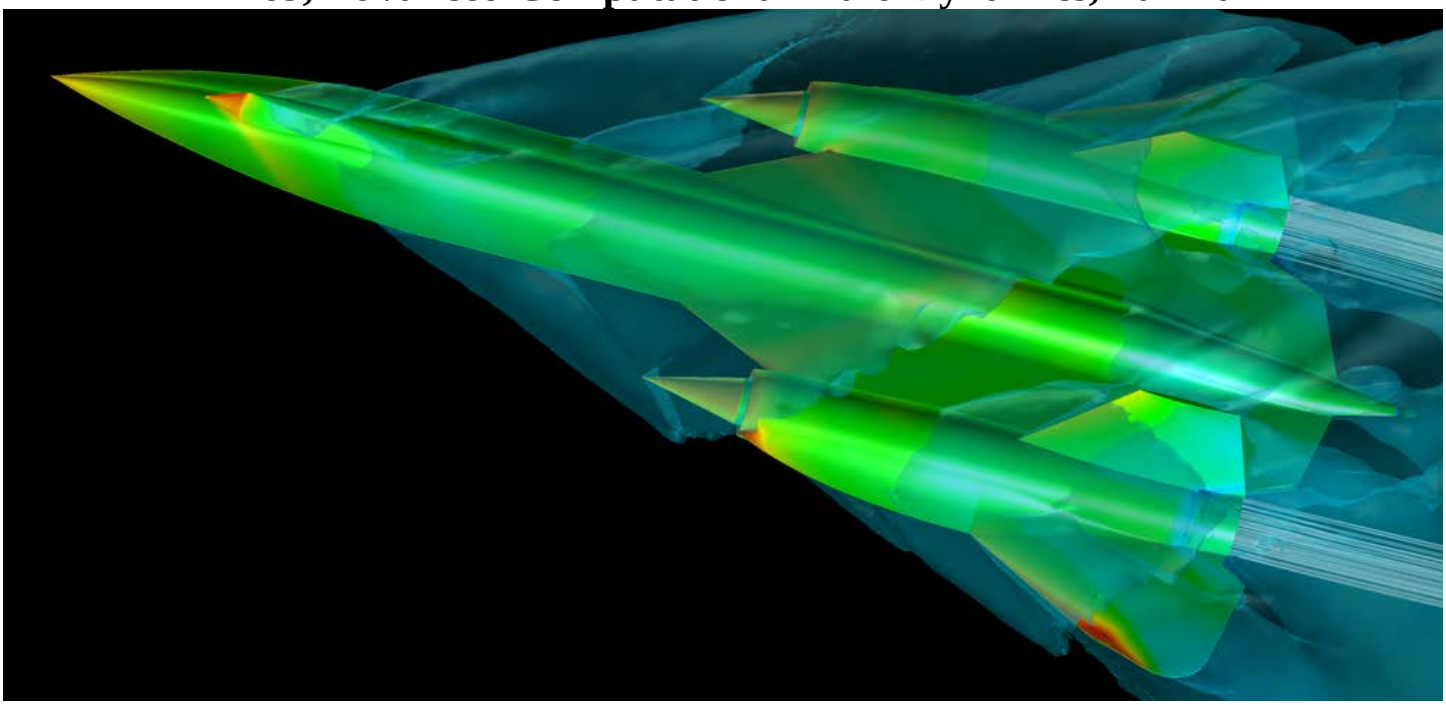
San José State University
Charles W. Davidson College of Engineering
Department of Aerospace Engineering
AE 269, Advanced Computational Fluid Dynamics, Fall 2017



Course and Contact Information

Instructor:	Dr. Periklis Papadopoulos
Office Location:	Engineering Building, Room 272E
Telephone:	(408) 924-7167
Email:	periklis.papadopoulos@sjsu.edu
Office Hours:	MW 4:30 pm – 5:30 pm
Class Days/Time:	W 18:00 – 20:30
Classroom:	ENG 164
Prerequisites:	BSAE or Instructor Consent

Course Description

The class will cover advanced topics in computational fluid dynamics and provide the students the opportunity to use numerical techniques to solve the Euler and Navier-Stokes equations. The students will use grid generation, CFD, and visualization software for exercises and projects. The students will use leading commercial CFD software, such as CFD-FASTRAN, for aerodynamic and aerothermodynamic applications, specifically designed to model real aerospace industry applications. Course will introduce the students to state-

of-the-art multiple moving body problems and the simulation of complex aerospace problems including missile launch, maneuvering and staging, and aircraft flight dynamics and store separation. The students will compute cases with the Navier-Stokes flow solver to benchmark its finite rate chemistry and thermal non-equilibrium modules. Students will be guided through these challenging applications.

Course Goals

Develop a basic understanding of algorithms and methods used to solve the Euler and Navier-Stokes equations of fluid mechanics.

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

1. Develop and use advanced numerical tools for the solution of flow problems
2. Perform stability analysis
3. Determine the accuracy of numerical methods
4. Design numerical methods based in linear theory
5. Perform benchmark studies for code-to-code validations and against experimental data.
6. Apply state-of-the-art CFD codes (FASTRAN) to aerospace applications.

Required Texts/Readings

Textbook

1. Fundamentals of Computational Fluid Dynamics by Lomax, Pulliam and Zingg. ISBN: 978-3642074844. Available at the SJSU Bookstore or from Springer-Verlag Publisher at http://www.springer.com/us/book/9783540416074

Other Readings

1. Numerical Computation of Internal and External Flows, Vol. 1 and 2, C. Hirsch, John Wiley & Sons, New York, 1988. ISBN: 978-0471923855 and 978-0471924524.
2. Computational Fluid Mechanics and Heat Transfer, D.A. Anderson, J.C. Tannehill and R.H. Pletcher, CRC Press, 2011. ISBN: 978-1591690375

Course Requirements and Assignments

Homework assignments will address computational geometry, grid generation, finite difference formulations, linearization, and boundary conditions. These topics will also be tested on the midterm. The course project will involve modeling the flow around a 2-D or 3-D aerodynamic body and will require computational geometry, grid generation, finite difference formulations, linearization, and boundary conditions as well as a stiffness and stability analysis. See weekly schedule below for important due dates.

Final Examination or Evaluation

Final project presentations will take place on the day and time of the final exam.

Grading Information

Assignment	Weight
Homework	25%
Midterm	25%
Final Project	50%

And the overall course grade (letter-grade) will be assigned based on the distribution below:

Percentage Grade	Letter Grade
95 or above	A+
90 – 94	A
85 – 89	A-
80 – 84	B+
75 – 79	B
70 – 74	B-
67 – 69	C+
65 – 66	C
60 – 64	C-
57 – 59	D+
55 – 56	D
50 – 54	D-
Below 50	F

Late assignments will not be accepted.

Note that "All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of their course grades." See University Policy F13-1 at http://www.sjsu.edu/senate/docs/F13-1.pdf for more details.

Classroom Protocol

Be on time, respect the instructor, no cell phone activity allowed, work well in teams.

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.sjsu.edu/gup/syllabusinfo/

AE Department Policies are posted at http://ae.sjsu.edu/program-policies

AE 269, Advanced Computational Fluid Dynamics, Fall 2017, Course Schedule

Schedule is subject to change with fair notice by class announcement.

Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1	8/24/2017	Introduction. Background on Advanced CFD trends and tools
2	8/31/2017	Computational Geometry
3	9/7/2017	Grid Generation / Computational Geometry
4	9/14/2017	Model Equations / Topological Constructs / ***Project Proposal Due***
5	9/21/2017	Advanced Mesh Generation Techniques / Discussion of Boundary Conditions
6	9/28/2017	Linearization, General Solutions, Finite Difference Formulations
7	10/5/2017	Generalization of Compact Difference Schemes
8	10/12/2017	Generalized Schemes of any Order; ***Midterm Exam***
9	10/19/2017	Central Differencing Schemes / ***1st Interim Project Report Due*** / ***1st Project Progress Presentations***
10	10/26/2017	Upwind Schemes
11	11/2/2017	Exact vs. Discreet Solutions
12	11/9/2017	General Solution of Coupled Systems of Equations
13	11/16/2017	Time Marching Methods / 2nd Interim Project Report Due / ***2nd Project Progress Presentations***
14	11/23/2017	Inherent and Numerical Stability
15	11/30/2017	Stiffness and Stability Analysis pt.1
16	12/7/2017	Stiffness and Stability Analysis pt.2
Final Exam	TBD	***Final Project Presentations***. ***Final project reports due.*** Venue TBD.