ASEN 5151 High Speed Aerodynamics
Spring 2018

Tu, Th 15:30-16:45 ECCR 110

Professor Thomas S. Lund

Office: ECOT 615
Hours: 15:30-17:00 Monday, Wednesday
Other times by appointment
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Course Web Site: `https://cora.nwra.com/~lund/asen5151`

Text: *Aerodynamics for Engineers* by John J. Bertin and Russell M. Cummings, 6th Edition, ISBN-13: 978-0132832885 or equivalently ISBN-10: 0132832887

Prerequisites:

Fluid mechanics, thermodynamics, vector calculus, partial differential equations.

Helpful background:

Gasdynamics, low speed aerodynamics, computer programming, ability to create engineering plots, ability to typeset mathematical equations.

Purpose and structure of the course

To provide an in-depth study of compressible fluid dynamics (gasdynamics) with special attention to aerodynamic applications. Important topics include treatment of weakly compressible flow, transonic flow, normal and oblique shock waves, expansion processes, entropy generation, and aerodynamic heating.

You will learn via a combination of reading, lectures, discussion, homework, and projects. The projects will encompass both analysis and computation and will focus on realistic aerodynamic design. Some computer programming will be required.

Course Outline

1. Basic concepts in gasdynamics (Chapter 8 in B&C)

   1st and 2nd laws of thermodynamics, entropy generation, flow processes at constant entropy, compressible flow in variable-area ducts, characteristic relations, expansion processes, shock waves, viscous boundary layers, shock/boundary layer interactions, scaling laws.

2. Subsonic and transonic flow (Chapter 9 in B&C)

   Linearized theory and compressibility corrections, critical Mach number, drag divergence, wings in transonic flow, drag reduction via sweep, transonic aircraft design considerations.

3. Supersonic thin airfoil theory (Chapter 10 in B&C)

   Linear theory, second order corrections, the shock-expansion method.

4. Supersonic flow over 3D wings and complete aircraft (Chapter 11 in B&C)

   Application of linear theory, conical flow, method of singularities, supersonic aircraft design considerations, slender body theory, base drag, aerodynamic interactions, analysis of complete configurations.

5. Hypersonic flow (Chapter 12 in B&C)

   Characteristics of hypersonic flow, Newtonian method, modified Newtonian method, waverider designs, aerodynamic heating, boundary layer transition.

Course Mechanics

Homework/projects: Approximately 7 homework and small project assignments will be given. These will be a combination of analysis, computation, and design. You are encouraged to work in groups to complete these assignments but you must submit your own uniquely prepared solutions.

Midterm Exam: Mid-term exam: Thursday, March 8, 15:30-16:45.

Final Project: A major component of the course is to complete an individual project, produce a report, and give a short (15 minute) presentation to the class. You can choose any relevant topic and focus on analysis, computation, design, etc.

Grades:

Homework	40%
Mid Term Exam	30%
Final Project	30%
	100%

Accommodation for Disabilities

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website `www.colorado.edu/disabilityservices/students`. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or injury, see Temporary Medical Conditions under the Students tab on the Disability Services website and discuss your needs with your professor.

Religious Holidays

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, contact Professor Lund directly to resolve any conflicts of this nature. See the campus policy regarding religious observances for full details.

Classroom Behavior

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteranstatus, political affiliation or political philosophy. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on classroom behavior and the Student Code of Conduct.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

The University of Colorado Boulder (CU Boulder) is committed to maintaining a positive learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct, discrimination, harassment or related retaliation against or by any employee or student. CUs Sexual Misconduct Policy prohibits sexual assault, sexual exploitation, sexual harassment, intimate partner abuse (dating or domestic violence), stalking or related retaliation. CU Boulders Discrimination and Harassment Policy prohibits discrimination, harassment or related retaliation based on race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy.

Individuals who believe they have been subject to misconduct under either policy should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127. Information about the OIEC, the above referenced policies, and the campus resources available to assist individuals regarding sexual misconduct, discrimination, harassment or related retaliation can be found at the OIEC website.

Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the academic integrity policy. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, resubmission, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code Council (honor@colorado.edu; 303-735-2273). Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code Council as well as academic sanctions from the faculty member. Additional information regarding the academic integrity policy can be found at the Honor Code Office website.