Instructor: Dr. Guoqiang Li  
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Office Hours: M. W: 1:00~2:00 pm or by appointment


Notes: Available online at http://www.ase.uc.edu/class/aeem445

Topics Covered:
1. Review of fundamental fluid mechanics and thermodynamics:  
   including important variables, concepts, review of thermodynamics,  
   compressibility (Aerodynamics, Chapter 1 & 7) and basic equations of mass,  
   momentum, and energy from control volume concepts (Fluids Mechanics,  
   Chapter 4);
2. One-dimensional flow:  
   Wave propagation and the speed of sound; (Aerodynamics, Chapter 8);  
   One-dimensional isentropic flow and/or normal shock waves (Aerodynamics,  
   Chapter 7 & 8);  
   Friction and heat addition for subsonic flows in constant area ducts; (Fluids  
   Mechanics, Chapter 12).
3. Two-dimensional flow  
   Oblique shock waves and Prandtl-Meyer flow in nozzles and diffusers  
   (Aerodynamics, Chapter 9);
4. Application to converging-diverging nozzles and diffusers and wind tunnels;  
   (Aerodynamics, Chapter 10; Fluids Mechanics, Chapter 12)  
5. Application to under and over expanded jets and airfoils; (Aerodynamics,  
   Chapter 11)

Projects:  
1. Design of supersonic nozzle in presence of friction and heat addition.  
2. Design a high speed wind tunnel, taking into account factors such as  
   compressor pumping time, model size and balance, and present results as a  
   technical report
Grading:

- 25% Homework and Quiz
- 25% Project
- 20% Midterm Exam
- 30% Final Exam

90-100 A, 80-89 B, 70-79 C, 60-69 D, 59 and below F

Policies: Late Homework – Not accepted without excuse PRIOR to deadline
Missed Tests – Zero grade without excuse PRIOR to test date.

Course Objectives:

1. Understand the concept of Conservation Equations in integral form for a Control Volume
2. Develop proficiency in manipulating the isentropic flow relations for a perfect gas; Determine the expression for the speed of sound for a perfect gas
3. Explain the concept of zone of silence and zone of action for supersonic flows
4. Determine the flow properties inside a converging-diverging nozzle for isentropic conditions; flows with normal shock; flows with oblique shocks and Prandtl-Meyer waves
5. Design a high speed wind tunnel, taking into account factors such as compressor pumping time, model size and balance, and present results as a technical report
6. Compute lift and drag using shock expansion theory for airfoils
7. Compute the flow-field variables in jets exhausting in quiescent air
8. Sketch the Fanno and Raleigh line T-S diagrams and compute the associated flow variables

Expectations of Students:

1. Attend each class;
2. Read ahead the text and notes;
3. Do problems in a timely manner;
4. Present professional quality assignments;
5. Ask/answer questions raised in class;
6. Contribute to the classroom discussion.

Assignment Preparation Rules:

1. Do not economize on paper at the expense of clarity. Work downwards or indicate direction;
2. States all assumptions!
3. Use the Given:, Find:, Solution format;
4. Clearly mark your answers.