ENME 483 - Physics of Turbulent Flow

Credits & Contact Hours: 3 credits (3 hours lecture, 0 hour recitation, 0 laboratory)

Course Status: Elective

Schedule: Offered every fall semester

Course Description: Fluid flow as it effects a wide range of technologies is turbulent. This includes the flow past automobiles, airplanes and wind turbines, the flow inside engines, the flow in the atmosphere and oceans and even in the human body. Understanding the physics of turbulent flow as it has been revealed through decades of experiment and computation is the main theme of this course. Such knowledge is an essential part of modern strategies for designing technologies to accommodate the presence of turbulent motion.

The course will focus on what is known about several specific problems of turbulent flow including automobile and truck aerodynamics and canonical flows including pipes, jets and boundary layers that are measured and simulated to gain basic understanding of turbulence. A goal of the course is to impart the necessary background for students to be able to critically assess and most effectively employ the turbulent flow prediction codes (e.g. Fluent) that are a mainstay of how turbulence is analyzed in modern industries.

In addition to lectures, some class time will be devoted to discussions of assigned readings taken from important articles in SAE Transactions, AIAA Journal and other sources that are relevant to the main topics of interest.

Pre-Requisites: ENME 331

Co-Requisites: None

Grading: Participation in class discussions of research articles 25%, computational assignments 25%, midterm and final 25% each


Other Required Material: Journal articles as specified in the curriculum.

Course Oversight: Fluid thermal subgroup

Syllabus Prepared By/Date: Dr. Peter S. Bernard, February 2016

Course Objectives/Student Learning Outcomes:

A. Understand the physics of turbulent flow.
B. Understand and be able to devise strategies for solving turbulent flow problems.
C. To an appropriate degree, be able to research and understand the literature in turbulent flow prediction, analysis and measurement.

Weekly Schedule:

1. Introduction. The nature of a turbulent flow study.
2. Automotive flows, numerical and experimental approaches.
5. Turbulent decay. Paper by Speziale and Bernard.
8. Vortical structures in turbulent flow. Papers by Adrian, and others.
10. LES modeling. Paper by Germano et al.
11. Examples of turbulent flow prediction including the use of Fluent.
12. Free shear flows including jets, shear layers and wakes.

Honor Code:
The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.studenthonorcouncil.umd.edu/whatis.html.”