ME61100 – Principle of Turbulence

Spring 2014

Course Syllabus

Objectives

- To provide a general introduction to the physics and mathematical description of turbulence;
- To introduce the methods of analysis used in turbulence study;
- To understand the principles of turbulence simulation and modeling.

Prerequisite

Graduate level fluid mechanics and engineering mathematics

Meeting Time

Mon/Wed/Fri 8:30-9:20am, ME 2053

Instructor

Prof. Jun Chen

Office: ME 2045 / CHAF 129

Phone: 765-494-7050 Email: junchen@purdue.edu

Office Hour

Mon/Wed/Fri 9:30-10:25am (appointment preferred)

Textbooks*

- ***Turbulent Flows***, By S. Pope, Cambridge University Press
- ***First Course in Turbulence***, By H. Tennekes & J. Lumley, MIT Press

Recommended Readings*

- ***Turbulence***, By J. Hinze, New York: McGraw-Hill
- ***The Theory of Homogeneous Turbulence***, By G. Batchelor, Cambridge University Press
- ***Incompressible Flow***, By R. Panton, J. Wiley

General Policy

- Attendance: class attendance is required.
- Homework: homework will be assigned periodically and will be due two weeks from the date that it is assigned.
- Exams: one mid-term and one final exam will be scheduled.
  - The mid-term exam will be 24-hour take-home.

  - The final will be 2.5-hour in-class exam (The first section will be close book 30-minutes exam. The second section will be open book/notes 2-hour exam).
- In-class presentation: In order to develop the ability to critically evaluate the literature, every student is asked to give two in-class presentations.
  - The first one will be given after midterm on assigned topics.
  - The second one will be given at the end of the semester on turbulence related topics selected by students. The topic selection must be approved before April 2nd, 2014.
  - Each presentation should be 20 minutes followed by 5-minutes for Q&A.
- Group discussion on course materials is permitted, but each student must finish homework and exams INDEPENDENTLY and NO TEAMWORK is allowed. Violations will subject to academic sanctions.

Grade Policy

- Homework: 20%
- Midterm (25%) and final exam (25%)
- Presentations: 15% + 15%
- Letter grade (+/-)

Emergency Plan

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Relevant information about changes in this course will be disseminated by course email list and Purdue Blackboard system.

ME61100 – Principle of Turbulence

Spring 2014

Progress Schedule *

wk	Date	Topic	Reading Assignments
1	Jan 13, 15, 17	Introduction, Mathematical Preparation	TL1, SP1
2	Jan 20 Jan 22, 24	Martin Luther King Jr. Day (No Class) Introduction to Statistical Analysis	SP3
3	Jan 27, 29, 31	Equations of Fluid Motions	SP2, SP9
4	Feb 3, 5, 7	Reynolds Averaged Equations	TL2
5	Feb 10, 12, 14	Free Shear Flows	TL4
6	Feb 17, 19, 21	Wall-bounded Turbulent Flows	TL5
7	Feb 24, 26, 28	Wall-bounded Turbulent Flows Introduction to Turbulent Transition Midterm (24-hour take-home, TBD)	TL5 Notes
8	Mar 3, 5, 7	First In-class Presentation (TBD)	
9	Mar 10, 12, 14	The Scales of Turbulent Motion	SP6
	Mar 17-22	Spring break (No Class)	
10	Mar 24, 26, 28	The Scales of Turbulent Motion	SP6
11	Mar 31, Apr 2, 4	Dynamics of Homogenous Turbulence	(#2 Topic Due)
12	Apr 7, 9, 11	Dynamics of Homogenous Turbulence Introduction to RANS Models	SP8, 10-11
13	Apr 14, 16, 18	Rapid Distortion Theory Introduction to Direct Numerical Simulation	SP11 SP9
14	Apr 21, 23, 25	Introduction to Large Eddy Simulation	SP13
15	Apr 28, 30 May 2	Introduction to Experiment Study of Turbulence Second In-class Presentation (TBD)	
16	May 5-10	Final Exam (TBD)	

* Subject to adjustment/change.