MAE 7340
ANALYSIS OF TURBULENT FLOWS
Fall 2013

Instructor: Professor S.B. Pope
254 Upson Hall, 5-4314
s.b.pope@cornell.edu

Assistant Instructor:
Dr. Jeonglae Kim
106A Rhodes Hall
jk984@cornell.edu

Website: pope.mae.cornell.edu/7340

Lectures: MWF 11:15–12:05, Upson 207

Recitation: MW 1:25–2:15, Upson 207
See web site for a detailed schedule

Required Text: S.B. Pope, *Turbulent Flows*, Cambridge, 2000

The course is divided into 7 two-week units. For each unit there is a homework assignment, many of which will include computational projects. Typically, these assignments will be available during the first week of the unit, and are usually due by 1:25 p.m. on the second Monday following the end of the unit. No late homework can be accepted, because the homework will be discussed in the recitation immediately following the deadline.

ACADEMIC INTEGRITY

Each student in this course is expected to abide by the Cornell University Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work. Collaboration and discussion with other students is encouraged for not-for-credit exercises.

COURSE OUTLINE

Unit	Weeks	Topic	Number of lectures	Readings from *Turbulent Flows* (sections in brackets not covered in lectures)
1	1	Introduction	1	1, (A, 2, B)
1	1-2	Statistical Description of Turbulence	5	(C), 3.1-3.5, (D,E), 3.6-3.8
2	3	Mean Flow Equations	2	4.1-4.2, (4.3), 4.4
2	3-4	Free Shear Flows	4	5.1-5.3, (5.4-5.5)
3	5-6	The Scales of Turbulent Motion	4	6.1-6.2, (6.3-6.5), 6.6-6.7
3	6	Direct Numerical Simulation (DNS)	2	8, (F), 9.1, (9.2), 9.3
4	7	Wall Flows	2	7.1, (7.2), 7.3, (7.4)
4	7-8	Turbulent Viscosity Models	4	(10.1-10.3), 10.4, (10.5)
5	9-10	Reynolds-Stress Models	6	11.1-11.6, (11.7), 11.8-11.10
6	11-12	PDF Methods (12.7), 12.8	6	12.1, H, (I), 12.2, J, 12.3-12.6,
7	13-15	Large-Eddy Simulation (LES)	6	13.1-13.4, (13.5), 13.6-13.7

READING

Text:

S.B. Pope *Turbulent Flows*, Cambridge University Press, 2000
(corrections pope.mae.cornell.edu/TurbulentFlows)

Fluid Mechanics:

D.J. Tritton, 2nd. Ed., *Physical Fluid Dynamics*, Oxford, 1988

Turbulence – classic texts:

H. Tennekes and J.L. Lumley, *A First Course in Turbulence*, MIT, 1972

S. Panchev, *Random Functions and Turbulence*, Pergamon, 1971

J.O. Hinze, *Turbulence*, McGraw Hill, 1975

A.A. Townsend, *The Structure of Turbulent Shear Flow*, CUP, 1976

A.S. Monin & A.M. Yaglom, *Statistical Fluid Mechanics Vol.* 1 & 2, MIT, 1975

Turbulence – recent texts:

P.A. Davidson, *Turbulence: An Introduction for Scientists and Engineers*, Oxford, 2004

P.S. Bernard and J.M. Wallace, *Turbulence Flow: Analysis Measurement and Prediction*, Wiley, 2002

J. Mathieu and J. Scott, *An Introduction to Turbulent Flow*, Cambridge, 2000

P.A. Durbin and B.A. Petterson Reif, *Statistical Theory and Modelling of Turbulent Flows*, Wiley, 2001

D.C. Wilcox, *Turbulence Modeling for CFD*, DCW Industries, 1993

U. Frisch, *Turbulence*, Cambridge, 1995

Stochastic Processes:

D.T. Gillespie, *Markov Processes*, Academic Press, 1992

C.W. Gardiner, *Handbook of Stochastic Methods*, Springer-Verlag, 1985

H. Risken, *The Fokker-Planck Equation*, Springer-Verlag, 1989