# MAE 214A, Winter 2009
# Turbulence

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- **Course description:** Fundamental aspects of turbulent flow will be discussed. Examples will be drawn from experimental and numerical studies of homogeneous turbulence, mixing layers, jets, wakes and boundary layers. Applications in engineering and in nature will be considered. Analytical tools to describe turbulent flows and associated mixing will be studied.

- **Prerequisites:** MAE 210A, 210B or equivalent.

- **Textbooks:** The following book will be used as the primary reference: *Turbulent Flows* by S. B. Pope. The book *Turbulent Flow* by P. S. Bernard and J. M. Wallace will also be used.

  A reading list is provided with the books in that list on reserve in the S&E library.

- **Course work:** There will be an in-class exam (30%) during the week of Feb. 9, three HWs (40 %) and a take-home exam due during Finals week. (30 %).

- **Lectures:** The times and location are: PCYNH 120 on Tuesday and Thursday, 3:30 - 4:50 PM

- **Office hours:** Monday 10:00-11:00

# MAE 214A
## Reading list
## (These books are on S&E library reserve)


S. B. Pope, Turbulent flows, Cambridge University Press, 2000.

P. S. Bernard and J. M. Wallace, Turbulent Flow: Analysis, Measurement and Prediction, John Wiley and Sons, 2002.

H. Tennekes and J. L. Lumley, A first course in turbulence, Cambridge, Mass., MIT Press, 1972.

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

M. Lesieur, Turbulence in fluids, 3rd revised ed, Kluwer Academic Publishers, 1997

H. Schlichting, Boundary-layer theory, 8th revised and enlarged edn, Springer, 2000.

A. A. Townsend, The structure of turbulent shear flow, Cambridge University Press, 1976.

J. O. Hinze, Turbulence, 2nd edition, New York, New York : McGraw-Hill, 1975.

P. A. Libby, An introduction to turbulence, Taylor and Francis, 1996.

J. S. Bendat and A. G. Piersol,Random data: analysis and measurement procedures, 3rd edn, Wiley, 2000.

# MAE 214 A
# Course Outline

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| Week 1 | Nature of turbulent flows. Averaging, Mean equations, Reynolds stresses. Chap. 1, 4 (Pope). Also, read Chap. 1 (B&W). |
| Weeks 2,3 | Free shear flows. Chap. 5. Also, read Chap. 5 (B&W). |
| Week 4 | Statistical tools: Chap. 3. Also, read Chap. 2 (B&W). |
| Week 5 | MIDTERM. Scales of turbulent motion. Chap. 6, Appendix D,E,F and G |
| Week 6 | Scales of turbulent motion (continued). Wall flows. Chap. 7 (Pope) & Chap. 4 (B&W) |
| Week 7 | Wall flows continued. |
| Week 8 | Turbulence in the environment. |
| Week 9 | Turbulent dispersion. Chap. 11 (B&W), 12.4 (Pope). Simple RANS turbulence models |
| Week 10 | Large eddy simulation. |

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