MTF256 Learning outcomes: week 5

November 29, 2010

1. Discuss the physical meaning of the different terms. The *mean* normal stress can be defined as $v^2_{rms,av} = \overline{v'_i v'_i}/3$; what sign will the pressure-strain term have for normal stresses, respectively, larger and smaller than $v^2_{rms,av}$? What role does Π_{12} has? What sign? Why do we call the pressure-strain term the *Robin Hood* term?

2. Consider the dissipation term, ε_{12}, for the shear stress: how large is it?

3. Consider fully developed channel flow: how are the expressions for the production terms simplified? Which production terms are zero and non-zero, respectively? Consider the production term for $\overline{v'_1 v'_2}$: which sign does it have in the lower and upper part of the channel, respectively? Why is there no pressure-strain term in the k equation?

4. Consider the fully turbulent region in fully developed channel flow: which are the main source and sink terms in the $\overline{v'^2_1}$, $\overline{v'^2_2}$, $\overline{v'^2_3}$ and $\overline{v'_1 v'_2}$ equations? Which terms are the largest terms at the wall? Which terms are zero at the wall?

5. Consider channel flow and use physical reasoning to show that $\overline{v'_1 v'_2}$ must be negative and positive in the lower and upper half of the channel, respectively. Is this consistent with the sign of P_{12}?

6. Define the two-point correlation. How is it normalized? What is the physical meaning of the two-point correlation? How is it related to the largest eddies? How is the integral length scale defined?

7. Define the auto correlation. How is it normalized? What physical meaning does it have? The integral time scale is defined in analogy to the integral length scale: show how it is defined.