$\mathrm{ME}~544$

Homework

Fluid Turbulence

For Tuesday, 17 April

Remember that the topic of your review paper, along with a brief description, is due.

Read Sections 11.1 to 11.3 of the text.

<u>Problem</u>. The paper by Tavoularis and Corrsin (*J. Fluid Mech.*, **1-4**: 311-347, 1981) detailing a laboratory experiment on homogeneous turbulent shear flow (see section 5.4.5, page 154 and ff. in text) has been put on the course website. In particular, Table 4, page 334, contains data of interest. In it are given the information to determine k, ϵ , and $\langle u_1 u_2 \rangle$ at three streamwise locations $(x_1/h = 7.5, 9.5, and 11.0)$.

Using the k- ϵ model (with the constants as given on page 375, Equation 10.54 of the text) and the computer code of your choice, initialize a simulation at $x_1/h = 7.5$, and run the calculation out to $x_1/h = 11.0$. Relate space (in the laboratory data) and time (in the k- ϵ equation developed in the text) as $x_1 = \overline{U}_c t$, where \overline{U}_c is the mean speed given in the data. Plot k, ϵ and $\langle u_1 u_2 \rangle$ versus x_1/h from the simulation on different plots, along with the laboratory data taken from the table. (So you should submit three plots.) Comment on the agreement between the model results and experimental results.