I. P. Castro & C. Vanderwel, *Turbulent Flows: An Introduction*, IOP, 2021.

Chapter 1 Sample Exercises

1.1. Make a list of industrial and environmental flows for which turbulence is a crucial component.

1.2. The file "TurbulenceSample.txt" contains a time history of the streamwise velocity measured in a wind tunnel using hotwire anemometry. It was sampled at 60 kHz for a total time of 30 seconds. Plot the signal of the velocity U (m/s) versus time (s). Take this opportunity to zoom in and out and consider the apparent "randomness" of the signal. Calculate the mean and variance of the signal.

1.3. Estimate the time taken for molecular processes to mix a source of carbon monoxide fully throughout a household kitchen, considering it be a cubical room of side $L = 3$ m and assuming a diffusivity rate on the order of 10^{-5} $\mathrm{m^2 s^{-1}}$.

1.4. Use the literature to explore the critical Reynolds number for transition in a pipe. On what factors might this depend?