

Chapter 5 Sample Exercises

- 📄 5.1. The file “HITData.txt” tracks the properties of a 512^3 DNS of decaying isotropic turbulence in time, including total energy, enstrophy, and integral lengthscale.
- Plot the total energy vs time and determine the exponent of the best power law fit (eq 5.3).
 - Determine the rate of turbulent kinetic energy dissipation as (i) $\epsilon = dk/dt$ (eq 5.1) and as (ii) $\nu \overline{\omega'_i \omega'_i}$.
 - Plot the development of the integral lengthscale scale in time.
 - Explore the validity of the equilibrium dissipation law (eq 5.26) and estimate C_ϵ .
- 📄 5.2. The file “HSFData.txt” contains measurements of the growth of the turbulent kinetic energy and Reynolds stresses in a wind tunnel realisation of a homogeneous shear flow by Tavoularis and Karnik (1989).
- Calculate the turbulent kinetic energy and plot it to see how it varies downstream. Does it grow or decay?
 - Determine the exponent of the exponential function $k = k_o e^{a\tau}$, as in equation (6.39), that best describes the variation of k as the flow develops downstream.
 - Determine the anisotropy coefficients using equation (6.38).