Coding Challenge #2, Fluids II: Due April 15 2019.

In 1939, Colebrook combined the smooth wall and fully rough relations for circular pipe flow into a clever interpolation formula:

$$\frac{1}{f^{1/2}} = -2.0\log_{10}\left(\frac{\epsilon/d}{3.7} + \frac{2.51}{\mathrm{Re}_d f^{1/2}}\right). \quad (1)$$

Known as the Colebrook equation, this equation can be used to find the dimensionless Darcy friction factor (f) when the Reynolds number (Re_d) and relative roughness (ϵ/d) of a pipe flow are known. This is an accepted design formula for turbulent friction. It was plotted in 1944 by Moody into what is called the Moody chart for pipe friction. The Moody chart is probably the most famous and useful figure in fluid mechanics.

1. Create a MATLAB fuction that solves the Colebrook equation for the friction factor (f) when the Reynolds number (Re_d) and relative roughness (ϵ/d) of a pipe flow are known. Compare your results with the Moody chart in your textbook (or from online) to confirm that your function works. Hint: The MATLAB command `fzero` may be useful.
2. Plot the friction factor vs Reynolds number for $\epsilon/d = 0.00357$, with Reynolds numbers in the range: $2300 < \mathrm{Re}_d < 10^7$. Use a log-log plot.
3. Use your function to solve the following problem: Consider the three-reservoir system in the figure with the following parameters:
   $L_1 = 95m, L_2 = 125m, L_3 = 160m, Z_1 = 25m, Z_2 = 115m, Z_3 = 85m.$
   All the pipes are unfinished concrete, with $d = 28cm$ and $\epsilon = 1mm$. The fluid is water ($\rho = 998kg/m^3$ and $\mu = 0.001kg/m \cdot s$). Compute the steady flow rates in all pipes.
4. Turn in the required results, as well as your MATLAB files.