A two-tank arrangement is set up as shown above. At steady state the tank levels are as given above and the flow rate is 22.7 gallons per minute (gpm).

(a) Develop a block diagram of the above system assuming that input is $Q_{i1}(s)$, the deviation of $Q_i(t)$ from its steady state value, and output is $H_2(s)$, the deviation of $H_2(t)$ from its steady state value. Do this in terms of system variables, i.e. not numerical values.

(b) Work out the numerical quantities for the blocks. Make sure that units work out correctly. We’ll want to enter $q_i(t)$ in gpm and output $h(t)$ in inches. Form the numeric block diagram for input and output in these units.

(c) What are the time constants for the two tanks?

(d) Find $\zeta$ and $\omega_n$ for the system.

(e) What is the steady state gain for the entire system?

(f) Use Matlab or Simulink to plot the system response to a step input of 1.6 gpm.