

BME 444
HW 3 - Due Feb 23

1. For the transfer function shown below plot the time response of a unit step input using (a) commands in MATLAB and (b) Simulink.

$$T(s) = \frac{5}{(s + 3)(s + 6)}$$

2. Find the time response of a unit step input to the SSR shown below using (a) commands in MATLAB and (b) Simulink.

$$\dot{\mathbf{x}} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -3 & -2 & -5 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 0 \\ 0 \\ 10 \end{bmatrix} r$$

$$y = [1 \ 0 \ 0] \mathbf{x}$$

3. Use Simulink (integrator block method) to simulate a non-linear model of the hydraulic tank system shown below. Assume the equation is

$$C\dot{P} = Q_{in} - K_T\sqrt{P - P_{atm}}$$

The input is Q_{in} and the output is P , tank base pressure

Assume the following:

$$C = 0.0002 \text{ m}^3/\text{Pa}$$

$$K_T = 4 \times 10^{-4} \text{ m}^{3.5}/\text{kg}^{0.5}$$

$$Q_{in} = 0.052 \text{ m}^3/\text{s}$$

$$P_{atm} = 1.0133 \times 10^5 \text{ N/m}^2$$

$$P_0 = 1.15 \times 10^5 \text{ N/m}^2$$

Note the P_0 , which is the initial pressure in the tank.

Run the simulation to $t = 1400$ sec

