**Control Theory**
Assignment #2

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1. Find a transfer function of the second-order system $G(s)$ that has damped oscillations and oscillates with a frequency of $f = 3Hz$. Note that $\omega = 2\pi f$. In Simulink, check that the response of this transfer function to the unit step meets the requirements.

2. Determine the transfer function $\frac{Y(s)}{U(s)}$ of the following block diagram.
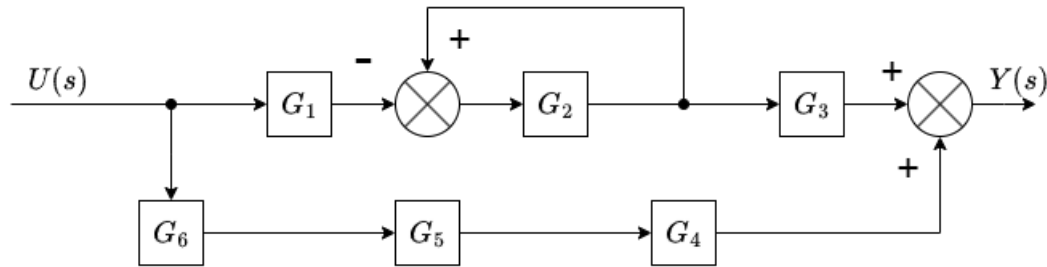
3. Determine the time delay of the following transfer function:

$$G(s) = e^{-1.8s}\frac{5}{s+1}$$

   Approximate the behavior of the time delay with the second-order Padé approximation.

4. Using both manual and Ziegler-Nichols tuning methods, set up a PID controller that would control a plant with the following transfer function.

$$G(s) = \frac{1}{s^3 + 3.95s^2 + 14.26s + 5.28}$$

   Show the resulting control loops in the Simulink environment.