SEOUL NATIONAL UNIVERSITY
SCHOOL OF MECHANICAL AND AEROSPACE ENGINEERING

SYSTEM ANALYSIS **Spring 2015**

HW.#9 **Assigned : May 21 (Th)**
Due: June 2 (Tu)

1. A system has two coupled subsystems. One subsystem is a rotational system with the equation of motion:

   $$50\frac{d\omega}{dt}+10\omega=T(t)$$

   Where $T(t)$ is the torque applied by an electric motor. The second subsystem is a field-controlled motor. The model of the motor's field current i_f in amperes is

   $$0.01\frac{di_f}{dt}+5i_f=v(t)$$

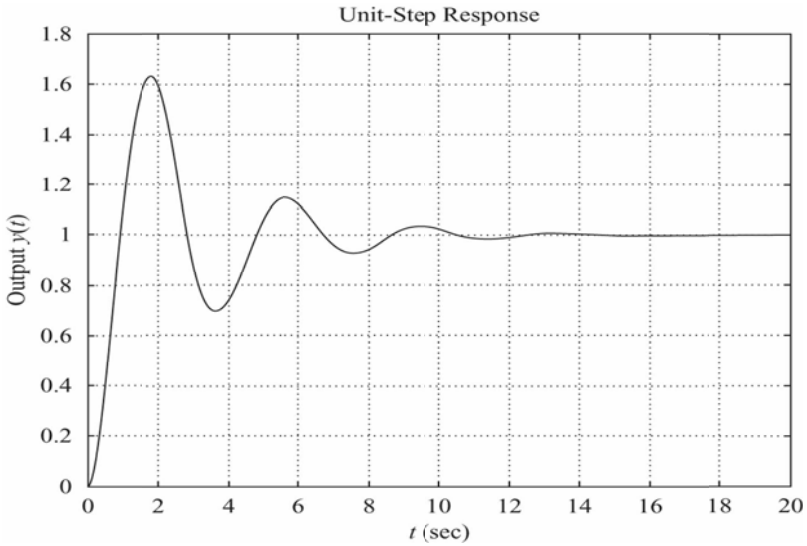
   Where $v(t)$ is the voltage applied to the motor. The motor torque constant is $K_T=25N\cdot m/A$.

   Obtain the damping ratio ζ, time constants, and undamped natural frequency ω_n of the combined system.

2. Figure given below shows the response of a system to a step input of magnitude 1000N. The equation of motion is

   $$m\ddot{x}+c\dot{x}+kx=f(t)$$

   Estimate the values of *m*, *c*, and *k*.



3. Sketch the bode plots for the system with following transfer function.

$$G(s) = \frac{10}{(0.2s+1)(s^2/100 + s/10 + 1)}$$

4. Using MATLAB, for K=1, 10, and 20, obtain bode plots of the system given as

$$G(s) = \frac{K}{s^3 + 6s^2 + 5s + K}$$

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