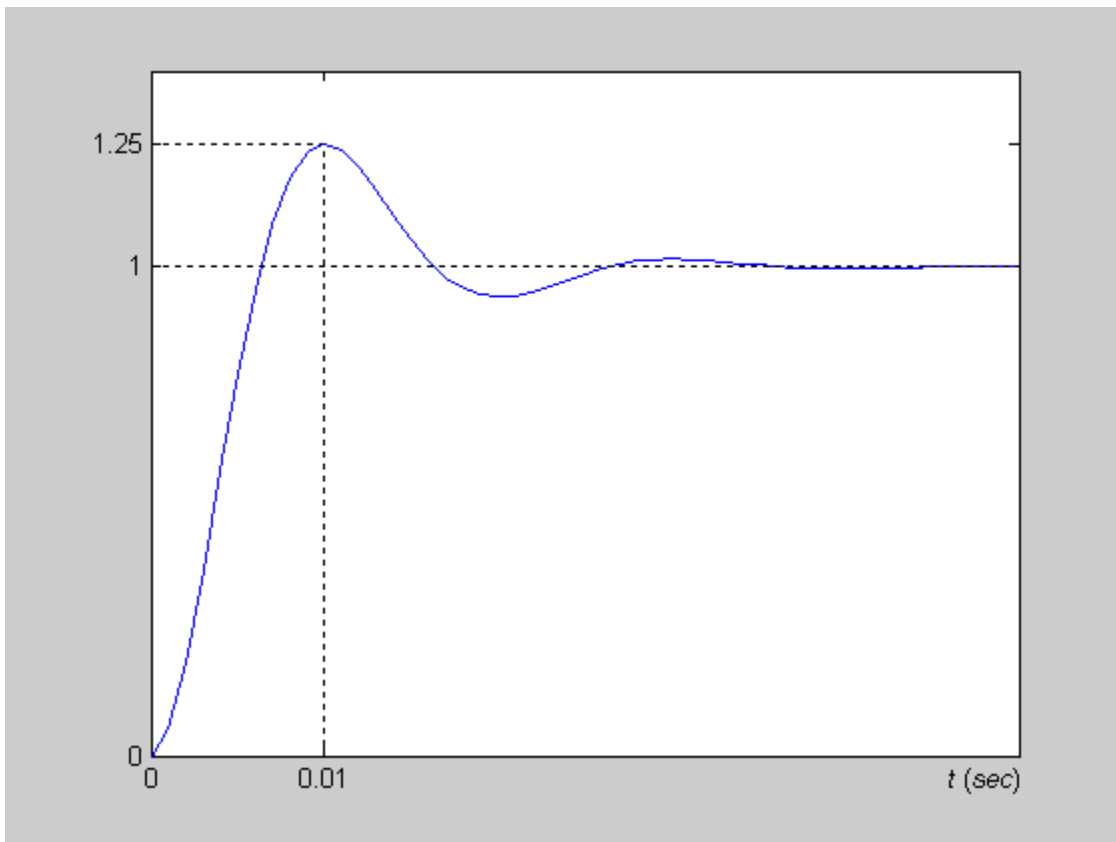
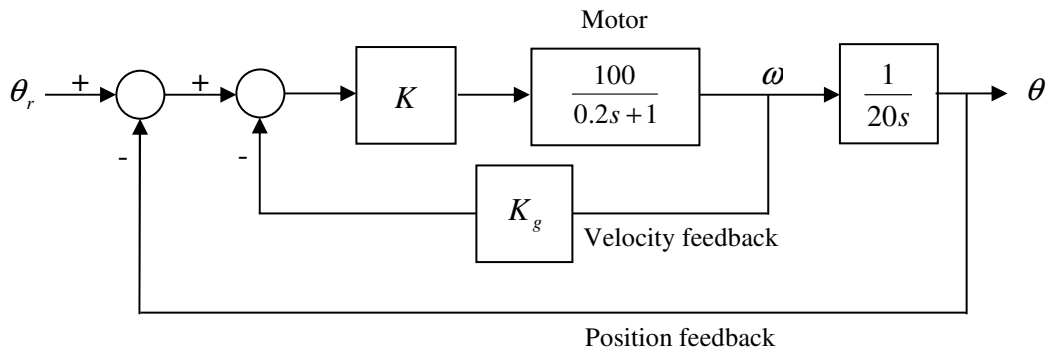


Concordia University
ELEC372 Fundamentals of Control Systems
Homework #5
Professor Amir G. Aghdam

1. (Automatic Control Systems by Farid Golnaraghi and Benjamin C. Kuo, Eighth Edition, John Wiley & Sons, Inc., 2010) “The unit step response of a LTI control system is shown in the following figure. Find the transfer function of a second-order prototype system to model the system.”



2. (Automatic Control Systems by Farid Golnaraghi and Benjamin C. Kuo, Eighth Edition, John Wiley & Sons, Inc., 2010) The block diagram of a servomotor is shown in the following figure:



- a) Find the values of K and K_g so that the percentage overshoot is 10% and the settling time of the unit step response is 0.05 sec.
- b) Repeat Part (a) with a percentage overshoot of 20% and a settling time of 0.01 sec.
3. Find the desired pole location of an underdamped second order system $G(s) = \frac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2}$ in order to meet the following specifications:
- $P.O. < 25\%$
 - $t_p < 10\text{sec}$
4. Consider a fourth-order system $G(s) = \frac{(s+1.05)}{(s+1)(s+20)(s^2+4s+8)}$. This system is to be approximated by a second order system $G_1(s) = \frac{K}{s^2 + 2\zeta\omega_n s + \omega_n^2}$ with the same DC gain as $G(s)$. Find $G_1(s)$.
5. Problem E5.8 from the 8th, 9th, 10th or 11th edition of the main textbook (E5.9 from the 12th, 13th or 14th edition).