BIRZEIT UNIVERSITY

Department of Electrical and Computer Engineering

Control Systems ENEE4302

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Deadline: 03/01/2020

Problem#1:

For the system shown in Fig.1

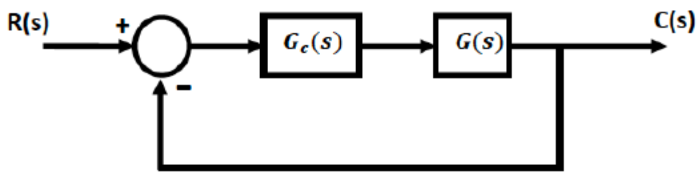


Fig.1

Let $\boldsymbol{G(s)} = \frac{1}{s(s+2)}$. Design a Lead Compensator $\boldsymbol{G_c(s)} = \boldsymbol{K_c}\,\frac{s+z_c}{s+p_c}$, such that damping ratio $\boldsymbol{\zeta = 0.3}$ and the natural frequency $\boldsymbol{\omega_n = 4}$ rad/sec. Using Matlab to do the following:

a. Plot root locus of the uncompensated and the compensated system.
b. Locate the zeros and poles of the closed loop system before and after using the compensator.
c. Show the unit step response and verify the overshoot of the system.

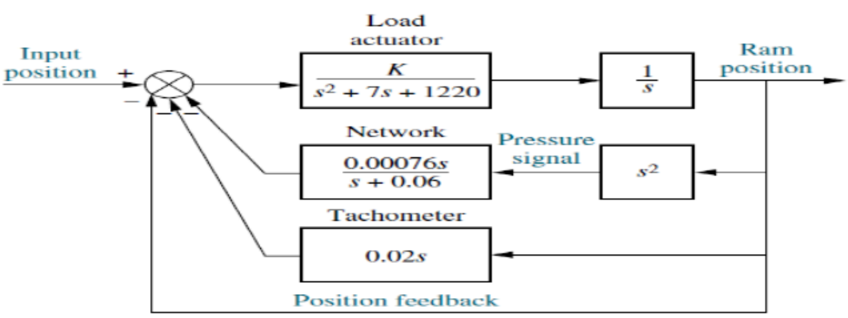
Problem#2:

Fig. 2(a) shows a robot equipped to perform arc welding. A similar device can be configured as a six-degrees-of-freedom industrial robot that can transfer objects according to a desired program. Assume the block diagram of the swing motion system shown in Fig. 2(b).

Use MATLAB to:

1. Determine the transfer function of the system (using Simulink).
2. Plot the root locus of the system.
3. Determine values of ***k*** for which the system is stable.
4. Determine the step response for four different values of ***k*** including stability and instability conditions (if exists).
5. If ***k*** = 64510, make a second-order approximation and estimate the transient parameters (rising time, settling time, overshoot). Compare and discuss the response obtained by MATLAB.
6. Determine the steady state error for the different values of ***k***. (***k*** = 64510, ***k*** > 64510, ***k*** < 64510). (Using Matlab)
7. Determine the state space representation for ***k*** = 64510.

(*a*)



(*b*)

Fig.2: (a) Robot equipped to perform arc welding; (b) block diagram for swing motion system.

GOOD LUCK ☺