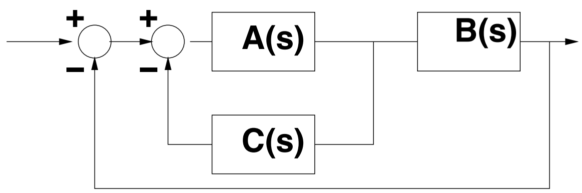
University of Massachusetts Lowell
Department of Electrical and Computer Engineering
EECE 4130

1. Given the system in the diagram



where $A(s) = M/(s + 2)$, $B(s) = 1/s$ and $C(s) = K$ find the M and K such that the damping ratio is equal to $zeta = 0.7$ and the undamped natural frequency is equal to 4 rad/sec.

2. Determine the conditions on K for stability

a. $s^4 + 6^3 + 11s^2 + 6s + K = 0$

b. $s^3 + (4 + K)s^2 + 6s + 16 + 8K = 0$

3. Draw the complete root-locus of

$$GH = \frac{K}{(s^2 + 2s + 2)(s^2 + 2s + 5)}$$

4. Draw the complete root-locus of

$$GH = \frac{K(s + 1)}{s(s - 3)}$$

5. Determine the root loci for the closed-loop unity negative feedback system $H(s) = 1$

$$G(s) = \frac{K}{s(s + 1)(s^2 + 4s + 5)}$$

6. Determine the root loci for the closed-loop unity negative feedback system $H(s) = 1$

$$G(s) = \frac{K(s + 9)}{s(s^2 + 4s + 11)}$$

a. By adjustment of the gain K locate the closed-loop poles on the root loci such that the dominant closed-loop poles have a damping factor equal to 0.5.

7. Consider the closed-loop unity negative feedback system where

$$G(s) = \frac{1}{s^2(s+4)}$$

Design a compensator $H(s)$ such that the unit-step response of the system has an overshoot $\leq$ 25% and a setting time of 5 seconds or less.