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ECE-320,
Quiz #6

For problems 1-3, consider a closed loop system with transfer function

$$G_0(s) = \frac{s+a}{s^2+bs+k}$$

1) The sensitivity to variations in *k*, $S_k^{G_0}(s)$, is

a) $\frac{k}{s^2+bs+k}$ b) $\frac{-k}{s^2+bs+k}$ c) 1 d) $\frac{k}{s+a} - \frac{k}{s^2+bs+k}$ e) none of these

2) The sensitivity to variations in *b*, $S_b^{G_0}(s)$, is

a) $\frac{-b}{s^2+bs+k}$ b) $\frac{-bs}{s^2+bs+k}$ c) 1 d) $\frac{b}{s+a} - \frac{bs}{s^2+bs+k}$ e) none of thes

3) The sensitivity to variations in *a*, $S_a^{G_0}(s)$, is

a) $\frac{a}{s^2+bs+k}$ b) $\frac{-a}{s^2+bs+k}$ c) 1) d) $\frac{a}{s+a}$ e) none of these

4) Assume we compute the sensitivity of a system with nominal value $a = 4$ to be

$$S_a^{G_0}(s) = \frac{1}{s+a}$$

For what frequencies will the sensitivity function be less than $\frac{1}{\sqrt{32}}$?

a) $\omega < 4$ rad/sec b) $\omega > 4$ rad/sec c) $\omega > 16$ rad/sec d) $\omega < 16$ rad/sec e) none of these

5) Assume we compute the sensitivity of a system with nominal value $a = 3$

to be

$$S_a^{G_0}(s) = \frac{s+2}{s+1+a}$$

For what frequencies will the sensitivity function be greater than $\sqrt{\frac{10}{16}}$?

a) $\omega < 4$ rad/sec b) $\omega > 4$ rad/sec c) $\omega > 16$ rad/sec d) $\omega < 16$ rad/sec e) none of these

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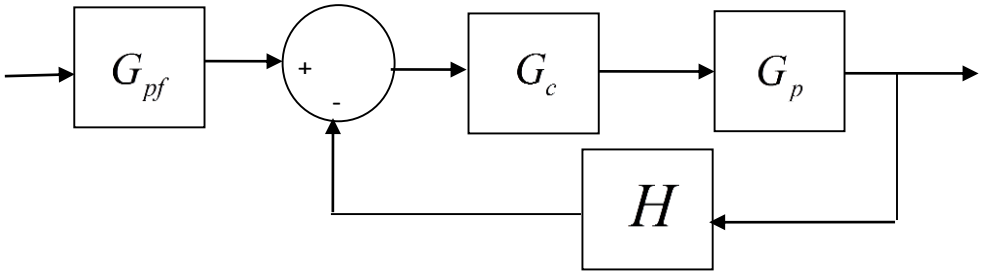
Problems 6-9 refer to the following system



6**)** To reduce the sensitivity of the closed loop transfer function variations in the plant G_p , we should

a) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ large b) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ small

c) make G_{pf} large d) do nothing, we cannot change the sensitivity

7) To reduce the sensitivity of the closed loop transfer function to variations in the prefilter G_{pf} , we should

a) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ large b) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ small

c) make G_{pf} small d) do nothing, we cannot change the sensitivity

8) To reduce the sensitivity of the closed loop transfer function to variations in the controller G_c we should

a) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ large b) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ small

c) make $|H(j\omega)|$ large d) do nothing, we cannot change the sensitivity

9) To reduce the sensitivity of the closed loop transfer function to variations in the sensor H , we should

a) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ large b) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ small

c) make G_{pf} large d) do nothing, we cannot change the sensitivity

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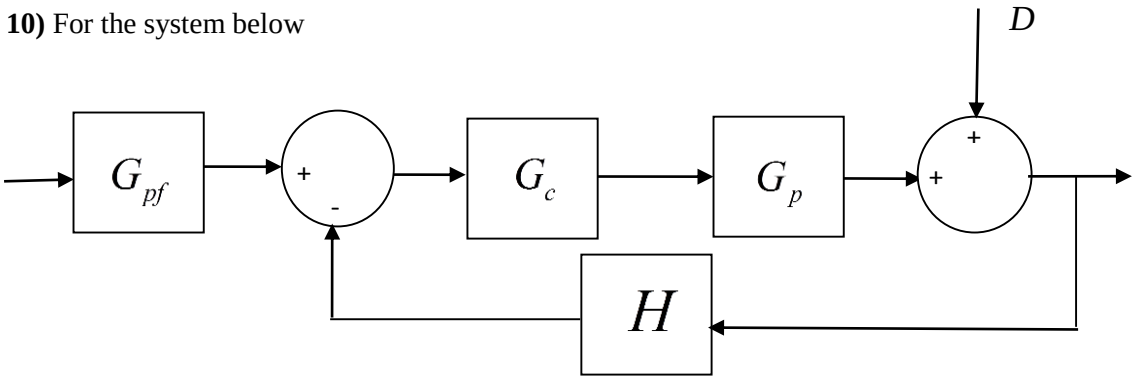
10) For the system below

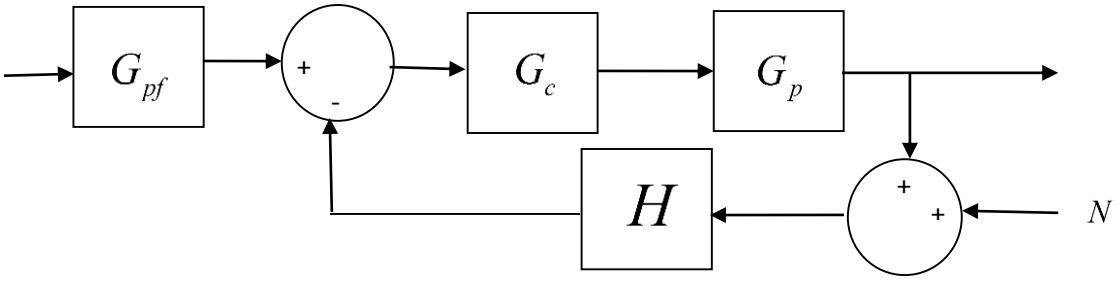


to reduce the effects of the external disturbance D on the system output, we should

a) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ large b) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ small

c) make G_{pf} large d) do nothing, we cannot change the sensitivity

11) For the system below



to reduce the effects of sensor noise N on the closed loop system , we should

a) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ large b) make $|G_c(j\omega)G_p(j\omega)H(j\omega)|$ small

c) make $|H(j\omega)|$ large d) do nothing, we cannot change the sensitivity

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For the problems 12 - 14, assume *a*, *b*, *c*, *d*, *e*, and *f* are real-valued numbers, and write and expression for the magnitude of the following:

12) $Z = \dfrac{a + j\omega b}{c - j\omega d}$

13) $Z = \dfrac{a + b - j\omega c}{d + j\omega}$

14) $Z = \dfrac{a + j + j\omega c + j\omega d}{1 - j\omega e + f}$

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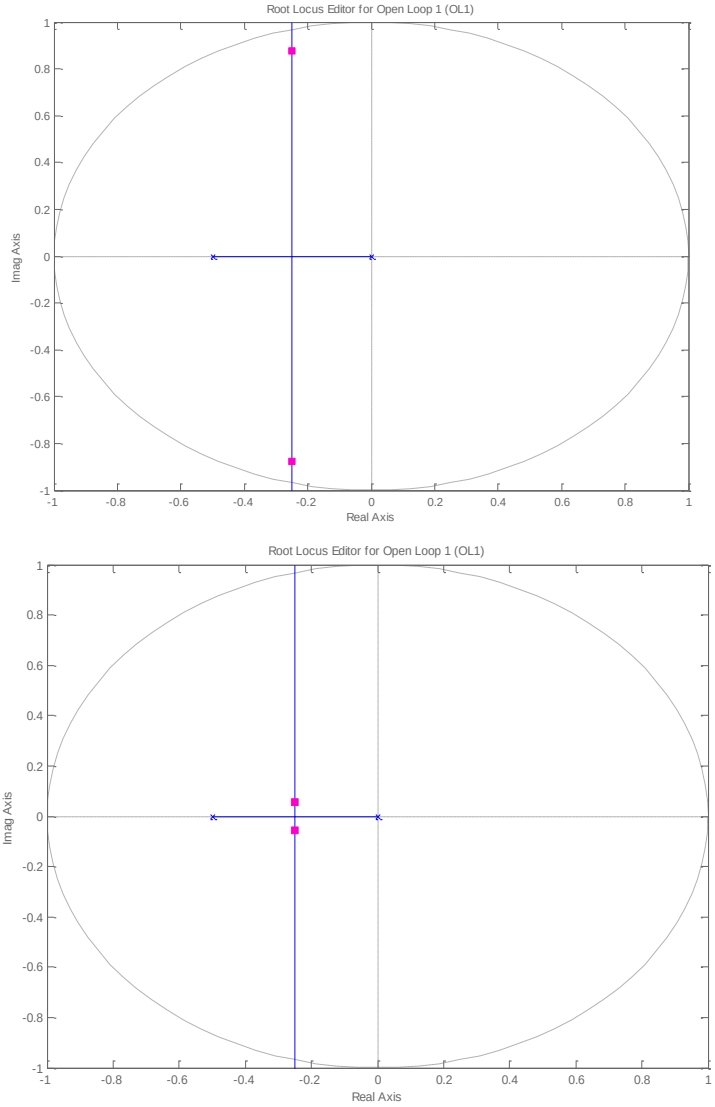
Problems 15 and 16 refer to the following two root locus plot for a discrete-time system



15) For which system is the settling time likely to be smallest?

a) The system on the top b) the system on the bottom c) the settling time will be the same

16) Is this a type 1 system?

a) yes b) no c) not enough information