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

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

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

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

a) $\dfrac{a}{s^2 + bs + k}$ b) $\dfrac{-a}{s^2 + bs + k}$ c) 1)   d) $\dfrac{a}{s+a}$ 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 $\dfrac{1}{\sqrt{32}}$?

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

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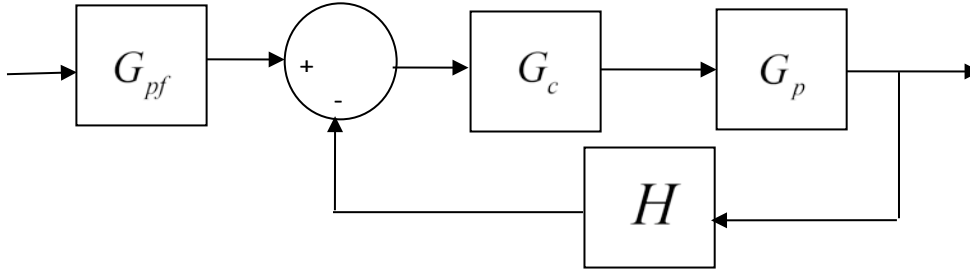
to be

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

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

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

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

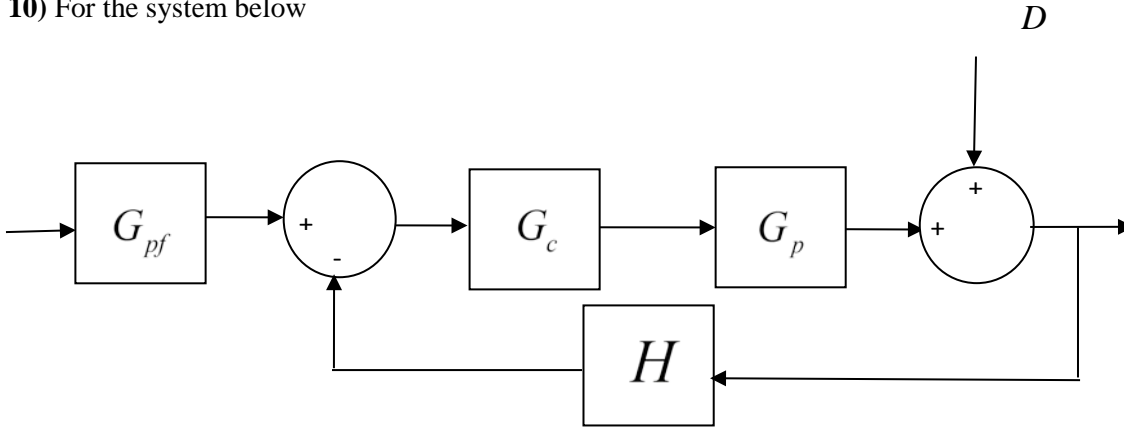c) make G_{pf} small   d) do nothing, we cannot change the sensitivity

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

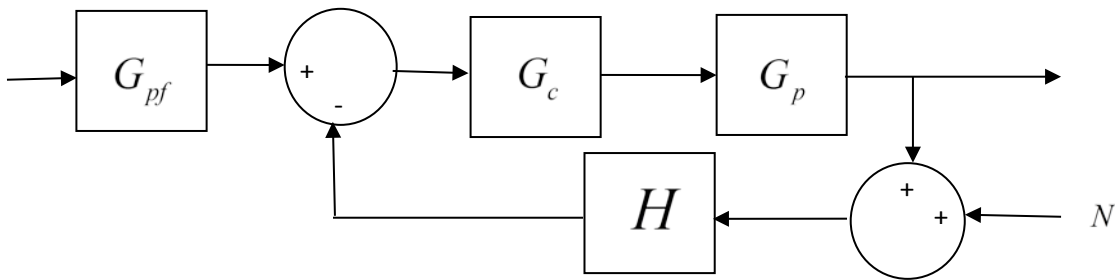c) make G_{pf} large   d) do nothing, we cannot change the sensitivity

10) For the system below

D

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

Answers: 1-b, 2-b, 3-d, 4-b, 5-a, 6-a, 7-d, 8-a, 9-b, 10-a, 11-b