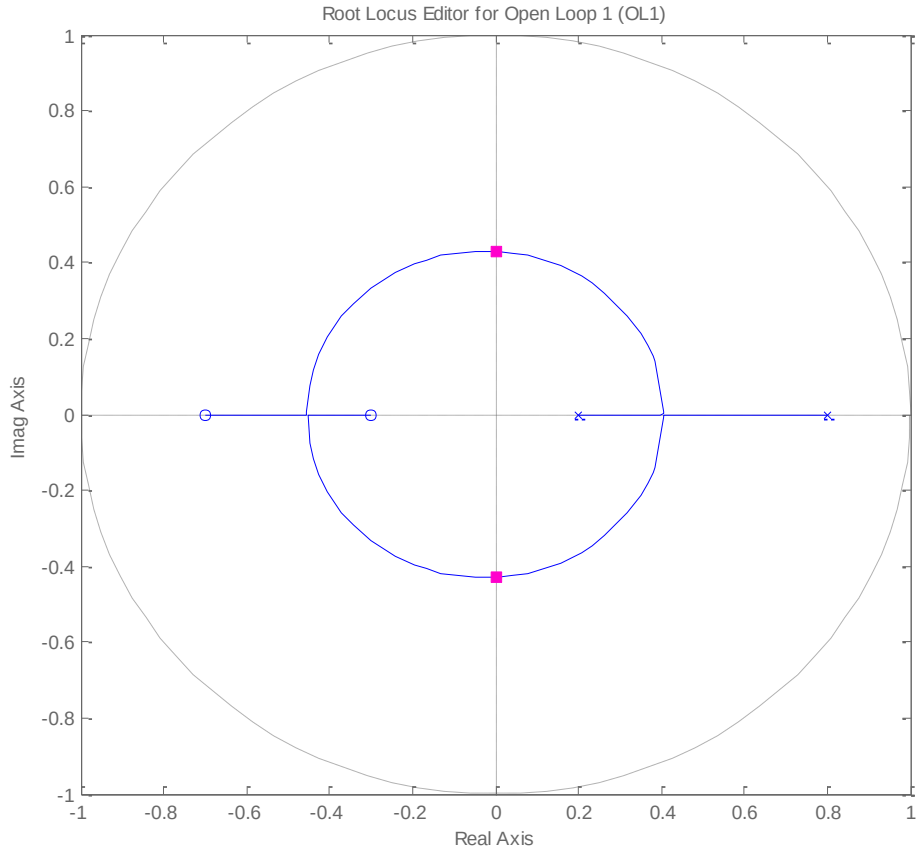
ECE-320,
Practice Quiz #5

Problems 1 and 2 refer to the following root locus plot for a discrete-time system



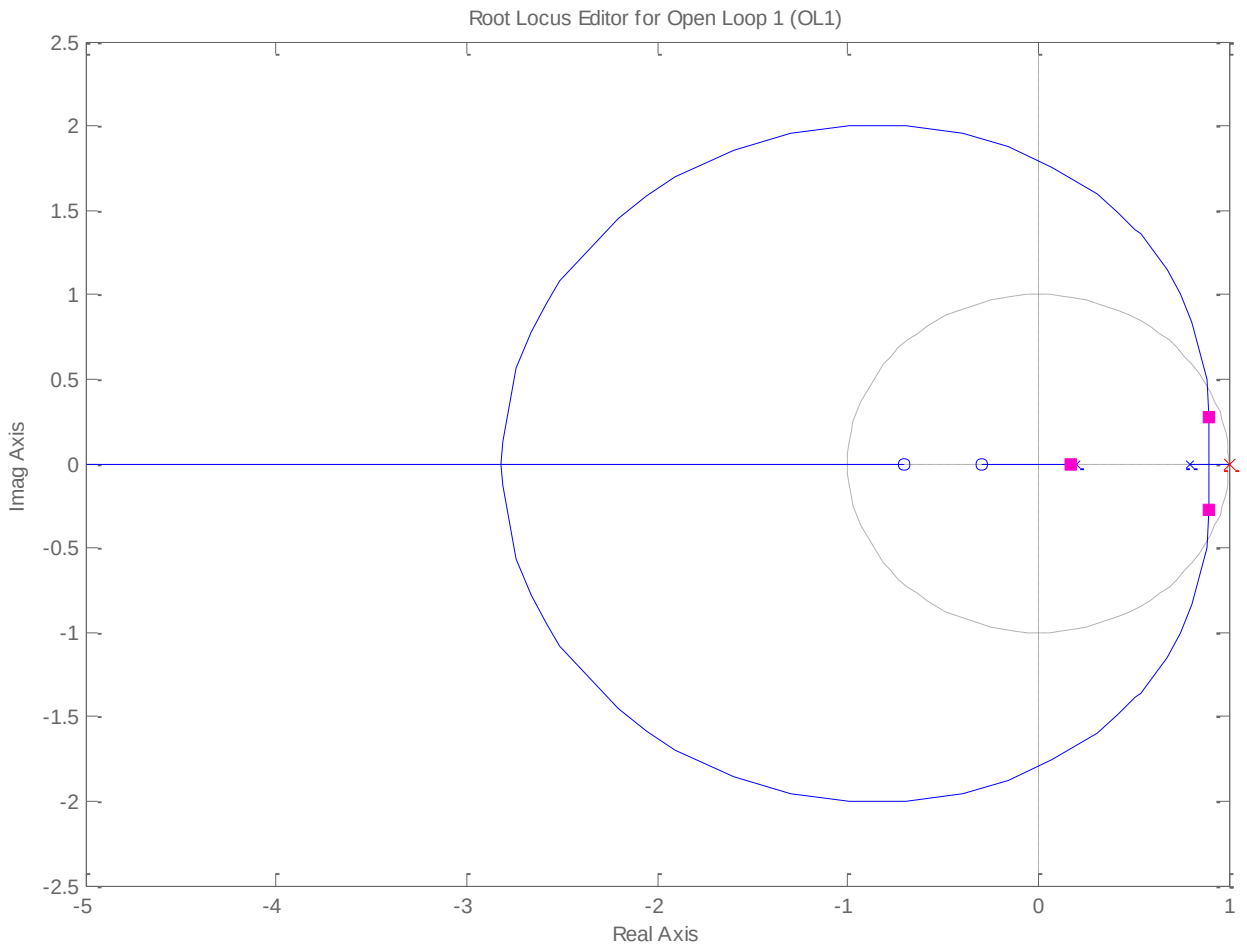
1) Are there any values of *k* (the variable parameter) for which the system is stable?

a) yes b) no c) there is not enough information to answer

2) As *k* increases, the close loop poles of the system

a) move to the left b) move to the right c) do not move at all

Problems 3-5 refer to the following root locus plot for a discrete-time system



3) With the closed loop pole locations shown in the figure, is the closed loop system stable?

a) yes b) no c) not enough information

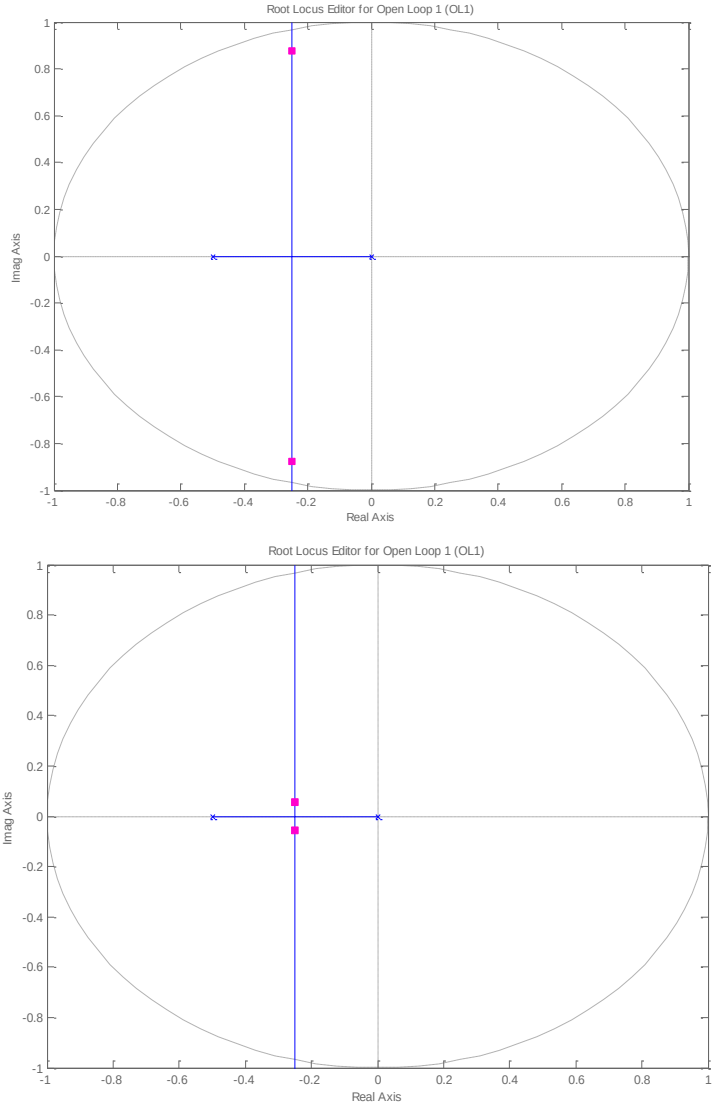
4) Is there any value of k for which the closed loop system is stable?

a) yes b) no c) not enough information

5) Is this a type one system?

a) yes b) no c) not enough information

Problems 6 and 7 refer to the following two root locus plot for a discrete-time system



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

a) The system on the left b) the system on the right c) the settling time will be the same

7) Is this a type 1 system?

a) yes b) no c) not enough information

For problems 8-10, consider a closed loop system with transfer function

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

8) 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

9) 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

10) 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

11) 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

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

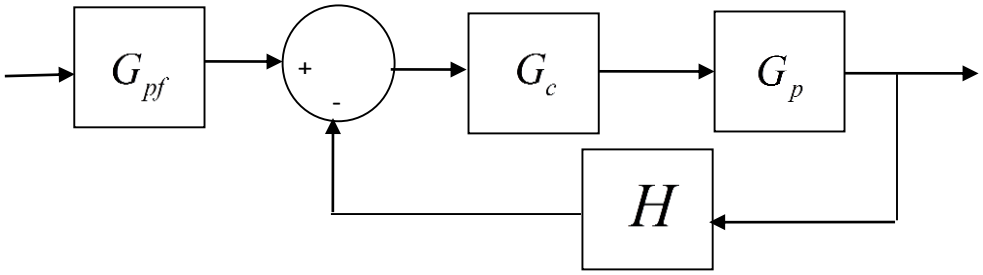
to be

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

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

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

Problems 13-16 refer to the following system



13) 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

14) 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

15) 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

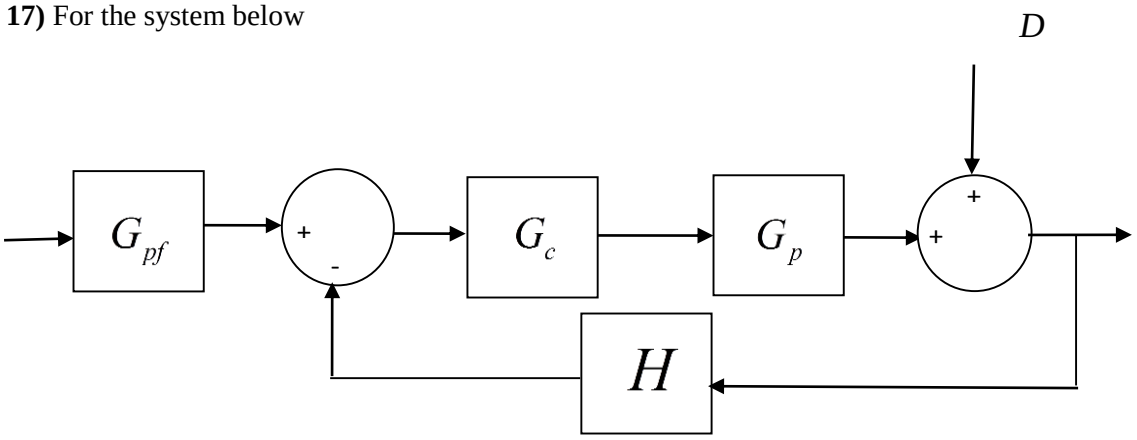
c) make $|H(j\omega)|$ large d) do nothing, we cannot change the sensitivity

16) 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

17) For the system below

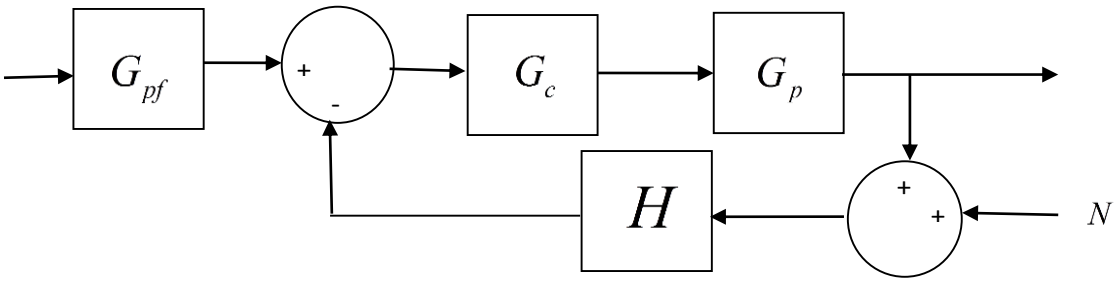


to reduce the effects of the external disturbance D on the system output, we should

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

18) For the system below

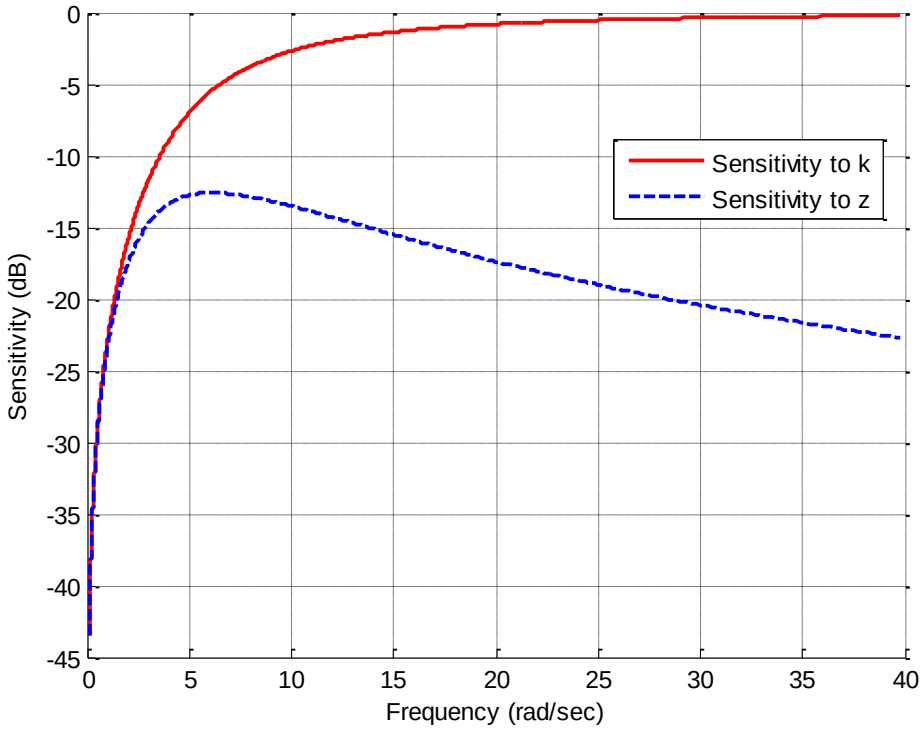


to reduce the effects of sensor noise N on the closed loop system , we should

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

19) The graph below shows a plot of the sensitivities to two parameters. Over this frequency range, the system is more sensitive to which parameter?



Answers: 1-a, 2-a, 3-a, 4-a, 5-a, 6-b, 7-b, 8-b, 9-b, 10-d, 11-b, 12-a, 13-a, 14-d, 15-a, 16-b, 17-a, 18-b, 19-k