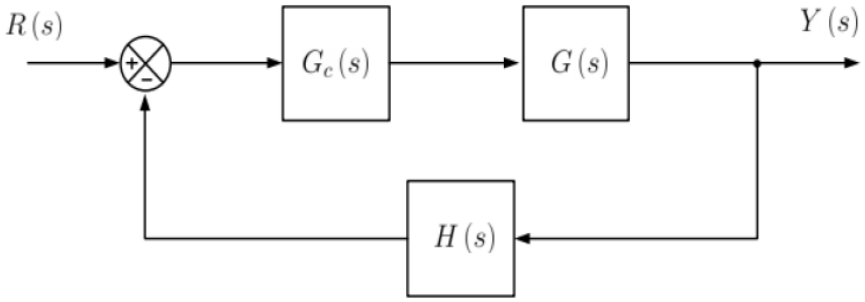
Questions (22) to (25) considers the following system:



where the plant $G(s) = \frac{G_o}{1+\frac{s}{Q\omega_o}+\left(\frac{s}{\omega_o}\right)^2}$, $G_o = 50,\ Q = 1.66,\ \omega_o = 2\pi(1000)$ and $H(s) = \frac{1}{2}$.

Transfer function $G_c(s)$ represents the compensator. (Hint: $10^{\frac{1}{(2*1.66)}} = 2$)

22. The uncompensated loop gain (i.e. $G_c(s) = 1$) has a unity gain frequency closest to
    a. 2 kHz
    b. 3 Khz
    c. 4 Khz
    d. 5 khz
    e. 6 kHz
23. The phase margin of the uncompensated system is closest to
    a. 60 degrees
    b. 40 degrees
    c. 20 degrees
    d. 0 degrees
    e. -20 degrees
24. We would like to design a proportional compensator with gain K_p. What should K_p be to achieve a unity gain bandwidth of 1.5 kHz.
    a. $K_p = 0.03$
    b. $K_p = 0.05$
    c. $K_p = 0.07$
    d. $K_p = 0.09$
    e. $K_p = 0.10$
25. The phase margin achieved by the proportional compensator design of Question 24 is closest to:
    a. 30 degrees
    b. 50 degrees
    c. 70 degrees
    d. 90 degrees