所別：光機電工程研究所碩士班 不分組 科目：自動控制

1. (15%) A control system as shown in the *Figure 1*. If the polar plot of $G(s)$ is as shown in *Figure 2*, where $A_1 = -2$, $A_2 = -1$, $A_3 = -0.5$, $A_4 = 0.2$ and $B = -0.4j$. Please find out the range of K to stabilize the closed-loop system.

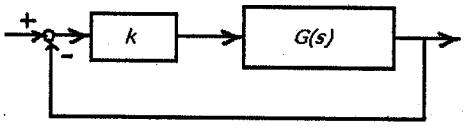

Figure 1

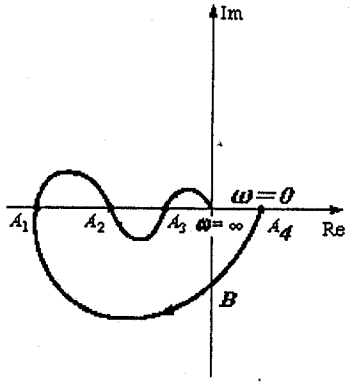

Figure 2

2. (15%) Please draw the polar plot and determine the corresponding gain and phase margins for the following transfer functions.

$$G(s) = \frac{6}{(s+2)(s^2+2s+2)}$$

3. (20%) If a closed loop system as shown in *Figure 1*, and the corresponding bode plot for *G(s)* is shown *Figure 3* and *K=0.1*.
   甲、Is the system is stable?
   乙、The steady state error for the closed loop system for unit step input reference.
   丙、Find the gain and phase margins.

參考用

注意：背面有試題

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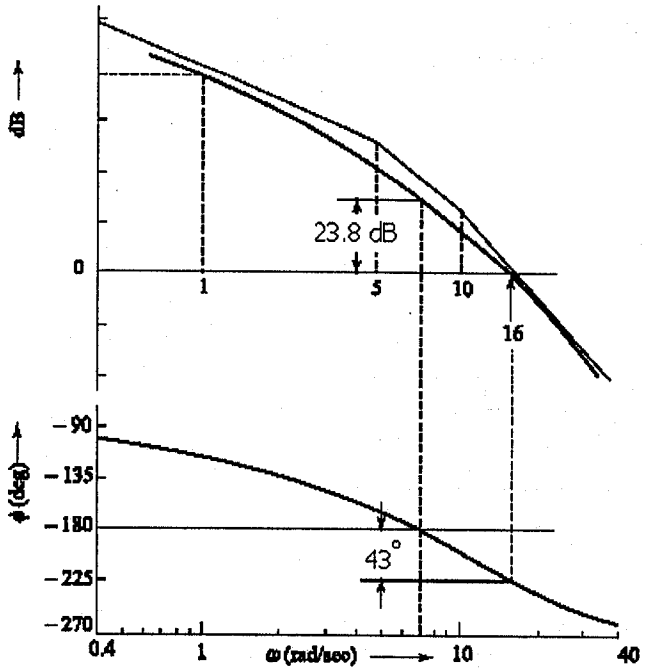
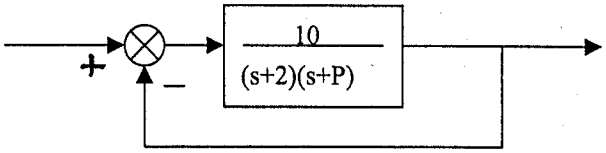


Figure 3

4. Given the following system,
(a) Find the equivalent system (i.e. PG(s)H(s)) whose denominator is 1+PG(s)H(s). (10 pts) (b) Find the root locus as a function of P. (10 pts). (c) Extend the concept to two-parameter characteristic polynomials $P(s)+K_1Q_1(s)+K_2Q_2(s)=0$ by stating how to approach the problem. (10 pts)



參考用

5. (a) In an S-plane, draw two lines of constant peak time (Tp), constant setting time (Ts) and constant percent overshoot (%OS), respectively, such that Tp1 > Tp2, Ts1 > Ts2 and %OS1 < %OS2. (10 pts) (b) For a second order system, we never talk about damping ratio (ζ) being negative. Please explain. (5 pts) (c) Find the time response for G(s) = (s+3) / (s+1)(s+2). (5 pts)