系所別：機械工程學系　丁組　科目：自動控制

1. The open-loop transfer function of a unity feedback system is

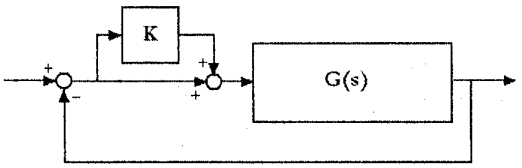
$$G(s) = \frac{K}{s(s+2)}$$

The desired system response to a step input is specified as peak time $t_p = 1$ sec and Overshoot $M_p = 5\%$.

(a) Determine where both specifications can be met simultaneously by selecting the right value of K. (15%)

(b) Sketch the associated region in the s-plane where both specifications are met. (5%)

2. 一閉迴路系統如下圖 (Fig. 1) 所示，



其中

$$G(s) = \frac{10}{2S^3+11S^2+17S+6}$$

(a) 請劃出 G(s)的 Nyquist Plot，並標示出它與實數軸與虛數軸的交點(15%)。

(b) 請問當 K=2 與 8 時，KG(jω)與實數軸的交點為何？(ω代表頻率)(5%)

(c) 就(b)所得之交點，說明當 K=2 與 8 時閉迴路是否為穩定的系統(5%)。

(d) 依據你所劃的 Nyquist Plot 找出使得上圖閉迴路穩定的 K 的範圍(5%)。

注意：背面有試題

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3. The open loop system with the transfer function is

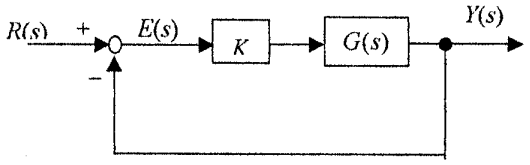
$$G(s) = \frac{1}{(s+1)(s^2+100)}$$

If the sinusoidal input signal $u(t) = 10\cos(100t)$ over the interval $0 \le t \le 10$ sec., assuming zero initial conditions.

(a) Compute the sinusoidal steady-state response $y_{ss}(t)$. (4%)

(b) Draw $u(t)$ & $y_{ss}(t)$ in a single plot, and comment on their relationships to one another. (4%)

Now, if the proportional control system is shown as the following figure.



(c) Draw the Bode plot for $K = 1$. (4%)

(d) Find the phase margin and gain margin of (c). Is the system stable? (4%)

(e) Determine the approximate range of K such that the control system is stable from (c). (4%)

4. Answer the following questions.

(a) In an s-plane, indicate poles that have the same envelope. (5%)

(b) Given Fig 1, to improve steady-state response only, an integrator is added in the forward path and this causes an extra pole at the origin, creating a new root locus. But in fact, the transient response was not affect appreciably. Why? (10%)

(c) Given a compensator $G_c=(s+z_c)/(s+p_c)$, how do you differentiate a lead compensator from a lag compensator in terms of z_c and p_c. (10%)

(d) Root locus technique is based on two criterions. Please describe them. (5%)

參考用