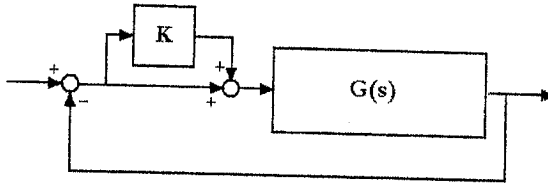系所別：　機械工程學系　戊組　科目：　　　自動控制

(1) 一閉迴路系統如下圖所示，
25%

其中

$$G(s) = \frac{10}{2S^3 + 11S^2 + 17S + 6}$$
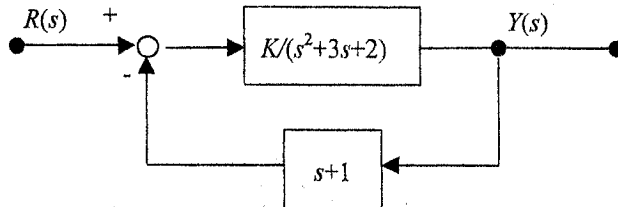
 (a) 請劃出 G(s) 的 Nyquist Plot，並標示出它與實數軸與虛數軸的交點。
 (b) 請問當 K=2 與 8 時，KG(jw) 與實數軸的交點為何？(w 代表頻率)
 (c) 就(b)所得之交點，說明當 K=2 與 8 時上圖閉迴路是否為穩定的系統。
 (d) 依據你所劃的 Nyquist Plot 找出使得上圖閉迴路穩定的 K 的範圍。

(2) Specification of control system design might require things like this
25%
 (i) Steady state error for a ramp input $\leq 10\%$
 (ii) Rise time of the system ≤ 0.5 Sec.
 (iii) Settling time of the system ≤ 5 Sec.
 (iv) Damping ratio of dominant roots ≥ 0.5
Using root-locus methods, find the range of the gain K for which the system in the following figure can achieve above specifications. The reference input $r(t)$ is a unit step.

(3) The open-loop transfer function of a unity feed back system is
20%
$$G(s) = \frac{K}{s(s+2)}$$

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%)
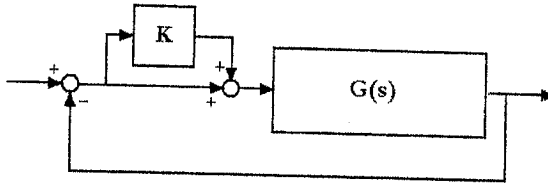
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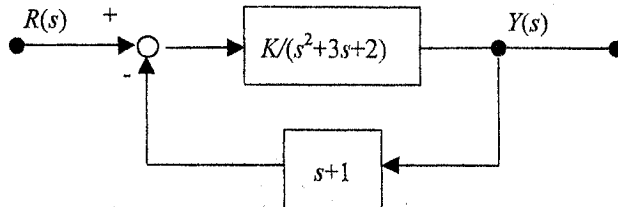25%

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