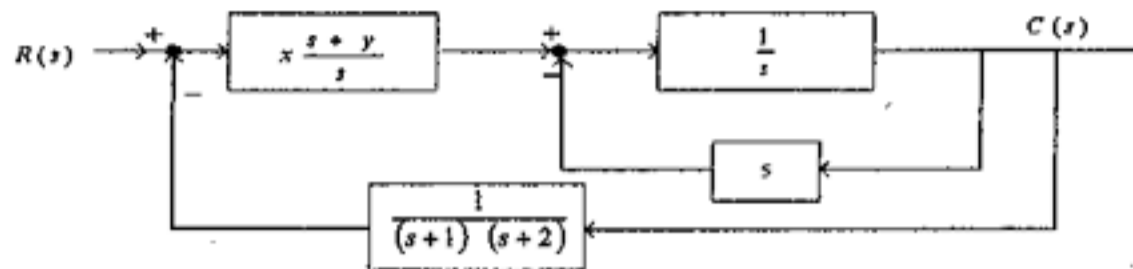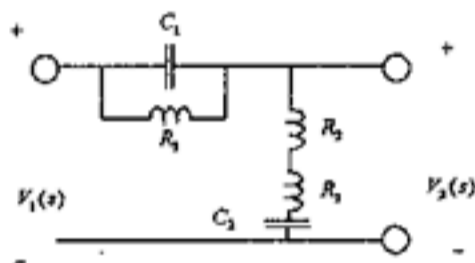1. (10%)下圖為一閉回路控制系統，請問使該系統穩定之 x、y 值的範圍，為在 x - y 座標平面上的第幾象限，且其 x 值的範圍為何?

2. (10%) 令右圖電路圖之轉移函數為

$$\frac{V_2(s)}{V_1(s)} = k\frac{(1+st_1)(1+st_2)}{as^2+bs+1}$$
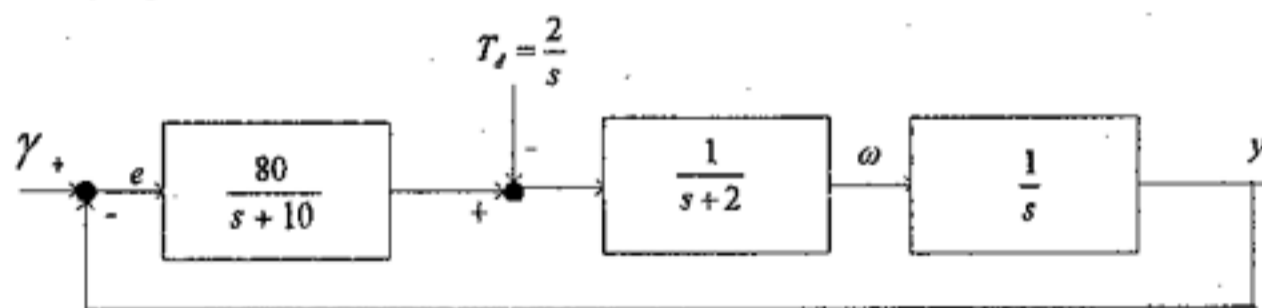
請問 k，t_1 和 t_2 值各為何?

3. (10%) 令 $C_1(sI-A_1)^{-1}B_1 = \dfrac{30s+30}{s^3+10s^2+31s+30}$

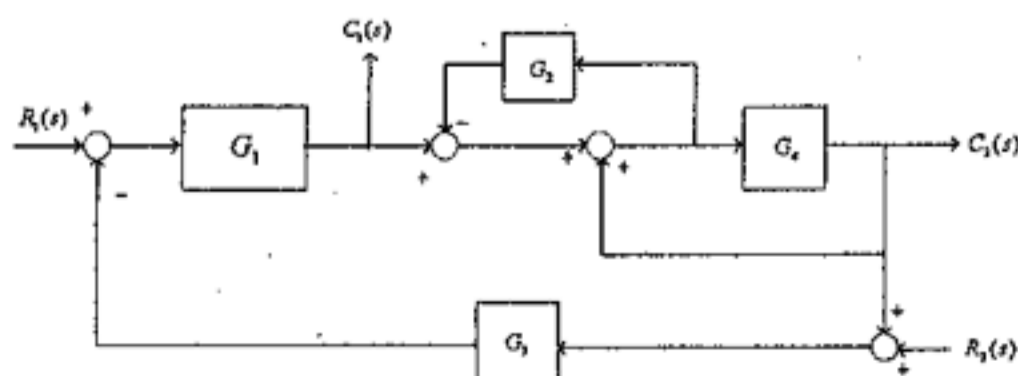$$C_2(sI-A_2)^{-1}B_2 = \frac{30}{s+3} - \frac{10}{s+2} - \frac{20}{s+5}$$

請問 (I)狀態空間矩陣 A_2，B_2，C_2 各為何?(5%)

(II) $C_2A_2B_2$ 減去 $C_1A_1B_1$ 為多少?(5%)

4. (10%)下圖為一馬達位置控置系統，請問當輸入為一單位步階函數 (unit step function)，其穩態誤差 $e = \gamma - y$ 為多少?

5. (10%) 請寫出下列控制方塊圖，由 $R_1(s)$、$R_2(s)$ 分別到 $C_1(s)$、$C_2(s)$ 之 2x2 轉移函數矩陣(transfer function matrix)。

(背面仍有題目,請繼續作答)

6. Give the definition and explain the use of a PID controller.
15%

7. If a servo system can be modeled as an integrator with unity feedback, discuss the frequency transfer behavior of closed-loop system through Bode plot.
15%

8. A feedback control system shown in the following figure is to be designed to satisfy the following specifications:

    1) Steady-state error for a ramp input is less than 35% of input slope

    2) Damping ratio of dominant roots is greater than 0.707

    3) Settling time to within 2% of the final value is less than 3 seconds

Find appropriate amplifier gain K_1 and derivative feedback gain K_2.
20%