

所別： 電機工程研究所 組別： 智慧型控制 科目： 自動控制

注意：  准  不准 使用計算器，考試時間總計： 100 分鐘。 試題共 2 頁，第 1 頁

1. (a) For the system shown in Figure 1, write the state equation and the output equation for the phase-variable representation. (10%)

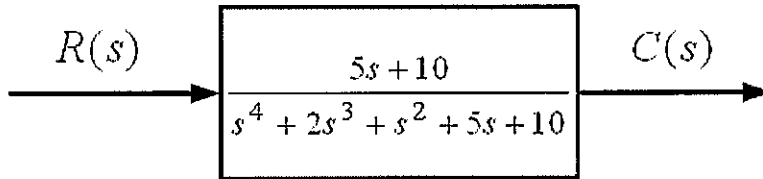


Figure 1

- (b) Find the transfer function  $G(s) = Y(s)/R(s)$  for the following system represented in state space. (10%)

$$\dot{\mathbf{x}} = \begin{bmatrix} 2 & -3 & -8 \\ 0 & 5 & 3 \\ -3 & -5 & -4 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 1 \\ 4 \\ 6 \end{bmatrix} r$$

$$y = [1 \quad 3 \quad 6] \mathbf{x}$$

2. Reduce the block diagram shown in Figure 2 to a single transfer function,  $G(s) = C(s)/R(s)$ , using block diagram reduction method (10%)

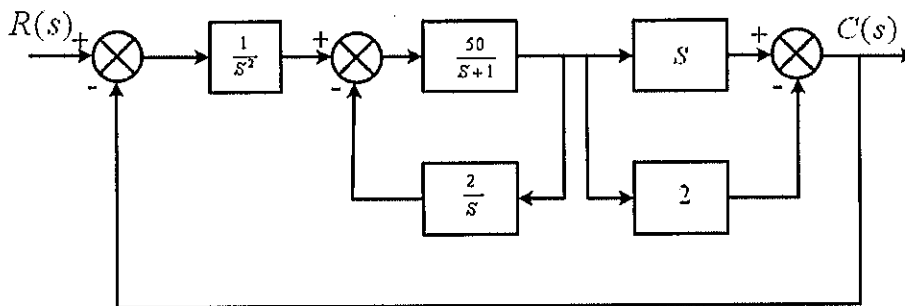


Figure 2

3. Using Mason's rule, find the transfer function,  $G(s) = C(s)/R(s)$ , for the system represented in Figure 3. (10%)

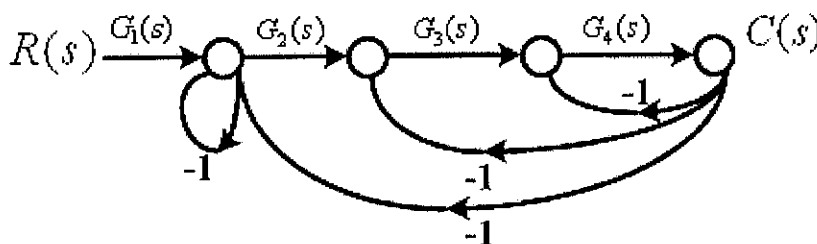


Figure 3

4. Using the Routh-Hurwitz criterion, tell how many closed-loop poles of the system shown in Figure 4 lie in the left half-plane, in the right half-plane, and on the  $j\omega$ -axis. (10%)

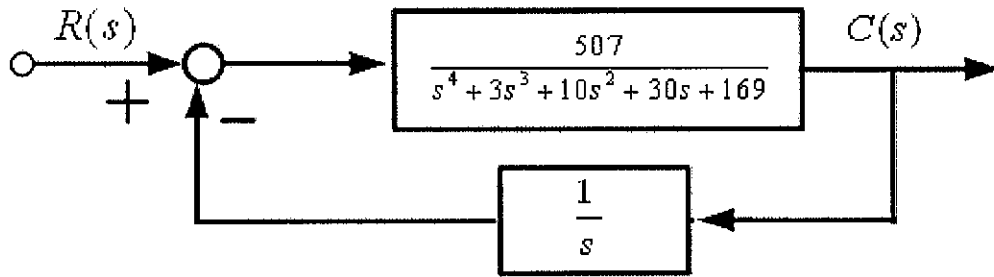


Figure 4

5. For the unity feedback system of Figure 4 with

$$G(s) = \frac{K}{(s+1)^3(s+4)}$$

- (a) Find the range of  $K$  for stability. (10%)  
 (b) Find the frequency of oscillation when the system is marginally stable. (10%)
6. For the unity feedback system of Figure 5, where

$$G(s) = \frac{K(s^2 + 2s + 5)}{(s+2)^2(s+3)}$$

- (a) Find the system type (5%)  
 (b) What error can be expected for an input of  $10u(t)$ ? (5%)  
 (c) What error can be expected for an input of  $10tu(t)$ ? (5%)

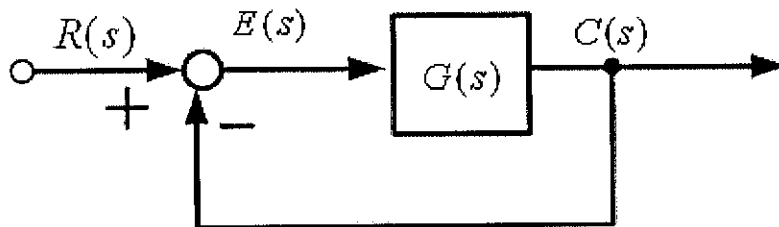


Figure 5

7. Sketching the root locus for the system shown in Figure 6. (15%)

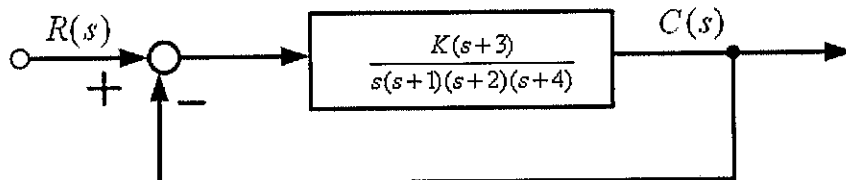


Figure 6