國立成功大學七十九學年度醫工所 考試(控制工程 試題) 共 2 頁 第 1 頁

*請依題號順序作答, 謝謝.

(1) For a model of physiological control system shown in Fig. 1, draw an equivalent signal flow graph, and find the overall transfer function.

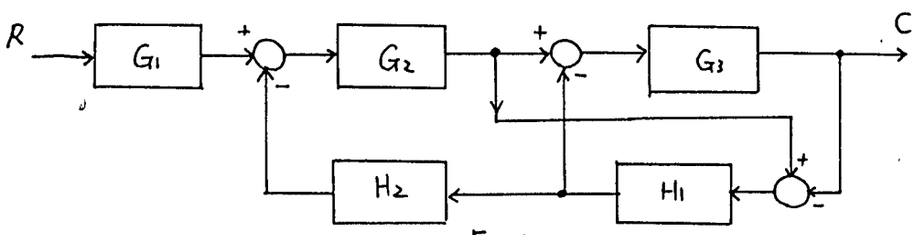

Fig. 1.

(2) A unity feedback control system has an open-loop transfer function

$$G(s)=\frac{K}{(s^2-4)(s+3)(s+1)}$$

(a) Sketch the root locus.

(b) Determine the range of K so that the system is stable.

(3) Determine the conditions on b_1, b_2, d_1 and d_2 so that the following system is completely state controllable and observable.

$$\dot{X}(t) = AX(t)+Bu(t)$$
$$C(t) = DX(t)$$

where $A=\begin{bmatrix} 2 & 1 \\ 0 & 2 \end{bmatrix}$, $B=\begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$, $D=\begin{bmatrix} d_1 \\ d_2 \end{bmatrix}$.

(4) One physiological system has the closed-loop transfer function as

$$T(s)=\frac{G_1(s)+k\,G_3(s)}{G_2(s)+k\,G_4(s)}$$

(a) Determine the sensitivity S_k^T.

(b) Using the result of (a) to determine the sensitivity of Fig. 2.

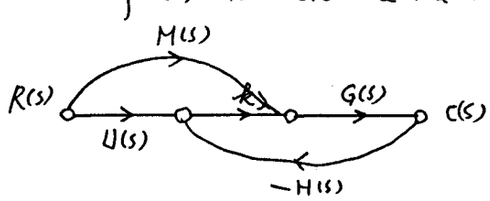

Fig. 2

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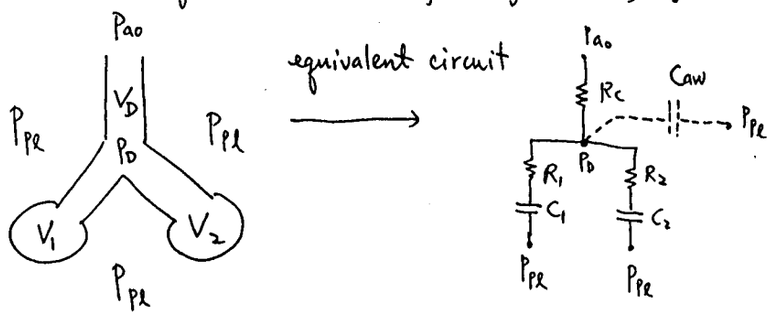
(5) Write the state equation for the following pulmonary system (Fig. 3).



(a) Fig. 3. (b)

Where P_{ao} : Airway pressure,

P_{pl} : plural pressure.

P_D : Pressure in the dead space

Caw, C_1, C_2 are the compliances

Rc, R_1, R_2 are the flow resistances.