

◎ 每大題 25%，合計 4 大題，共計 100%。

1. Fig. 1 shows two blocks of a control system and the differential equations relating input and output. Assumed all initial conditions for b and y are zero, find the Lapalce transform of the transfer function between $x(t)$

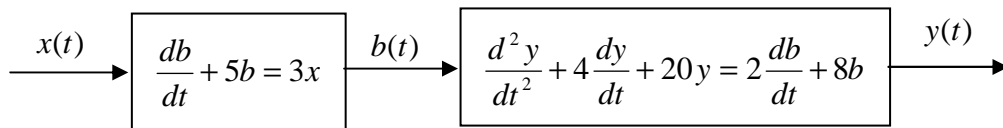


Fig.1

2. Consider a system defined by the following state-space equations:

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -5 & -1 \\ 3 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 2 \\ 5 \end{bmatrix} u, \quad y = \begin{bmatrix} 1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

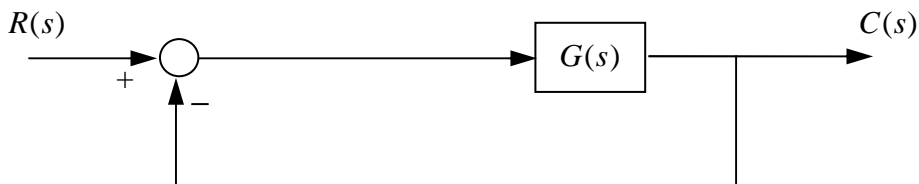
obtain the transfer function $G(s)$ of the system.

3. Give the quadratic function as follows.

$$V(X) = 10x_1^2 + 4x_2^2 + x_3^2 + 2x_1x_2 - 2x_2x_3 - 4x_1x_3, \text{ where } X \text{ is the state vector.}$$

- (a) Put the $V(X)$ in the matrix form of $V(X) = X^T P X$. What is the matrix P ?
 (b) Use Sylvester's criterion to verify whether or not the $V(X)$ is positive definite.

4. Please sketch the root-locus plot of a system with complex-conjugate open-loop poles.



$$G(s) = \frac{K(s+2)}{(s^2 + 2s + 3)}, \quad H(s) = 1, \text{ The poles of } G(s) \text{ are } s = -1 \pm j\sqrt{2}$$