國立彰化師範大學 99 學年度碩士班招生考試試題

系所：車輛科技研究所　　選考甲　　科目：自動控制

☆☆請在答案紙上作答☆☆　　

1. Find the solution $x(t)$ of the differential equation
   $\ddot{x} + 3\dot{x} + 2x = 0$ and the initial conditions: $x(0)=a$, $\dot{x}(0) = b$,
   where a and b are constant. (20%)

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

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

$$y = \begin{bmatrix} 1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}.$$

   Obtain the transfer function of the system. (20%)

3. A simplified version of an automobile or motorcycle suspension system is shown in Figure 1. Obtain the transfer function from input $u(t)$ to $y(t)$. (20%)

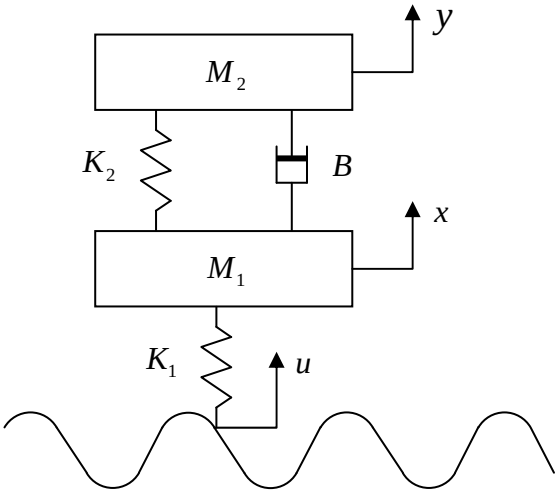

Figure 1.

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4. Determine the range of K for stability of the close-loop transfer function as follows. (20%)
$$\frac{K}{s(s^2+s+1)(s+2)+K}.$$

5. Obtain the transfer function Y(s)/X(s) of the system shown in Figure 2. (20%)

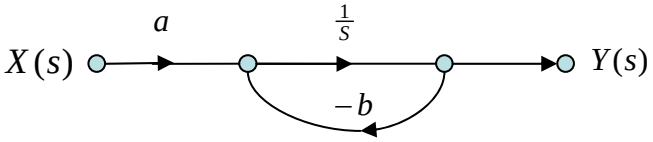

Figure 2.