國立雲林科技大學 系所：電機系
100學年度碩士班暨碩士在職專班招生考試試題 科目：自動控制(2)

1. Reduce the system shown in Figure 1. to a single transfer function, T(s)=C(s)/R(s) (15%)

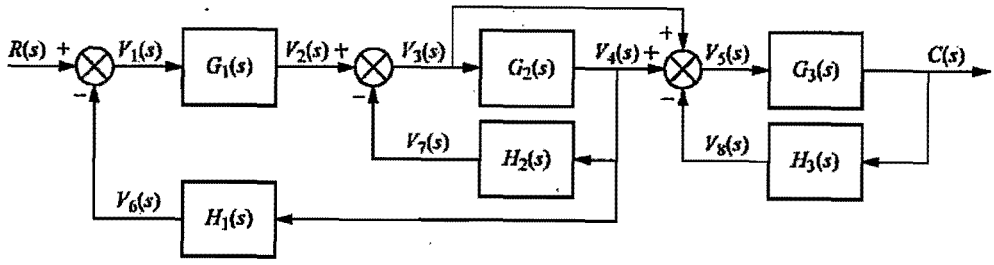

Figure 1.

2. Find the transfer function $G(s)=V_O(s)/V_i(s)$, for the circuit given in Figure 2 (15%)

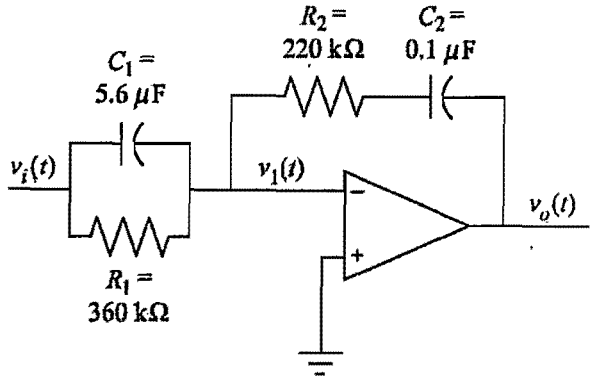

Figure 2

3. Find the state space representation of the electrical network shown in Figure 3. The output is $v_0(t)$. (10%)

$$X=\begin{bmatrix} V_{C1} \\ i_L \\ V_{C2} \end{bmatrix}, \quad V_{C2}=V_O$$

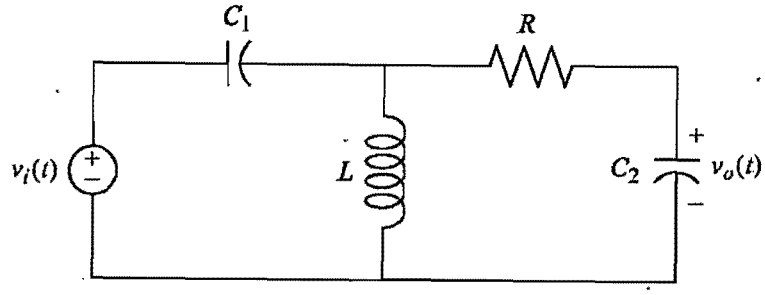

Figure 3

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4. Linearize the equation for small excursions about $x = \pi/4$ (10%)

$$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + \cos x = 0$$

5. Plot the root locus of the characteristic equation $1 + G(s)D(s) = 0$ where

$$G(s) = \frac{(s+0.1)^2 + 6^2}{s^2\left[(s+0.1)^2 + 6.6^2\right]}$$

is in a unity feedback structure with the controller transfer function (25%)

$$D(s) = K\frac{s+1}{s+12}$$

6. Suppose you have a pendulum with frequency w_0 and a state-space description given by

$$\begin{bmatrix}\dot{x}_1 \\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1 \\ -w_0^2 & 0\end{bmatrix}\begin{bmatrix}x_1 \\ x_1\end{bmatrix} + \begin{bmatrix}0 \\ 1\end{bmatrix}u$$

Find the control law that places the closed-loop poles of the system so that they are both at $-2w_0$ and compute the estimation matrix that will place both the estimation error poles at $-10w_0$. (25%)