國 立 臺 北 科 技 大 學

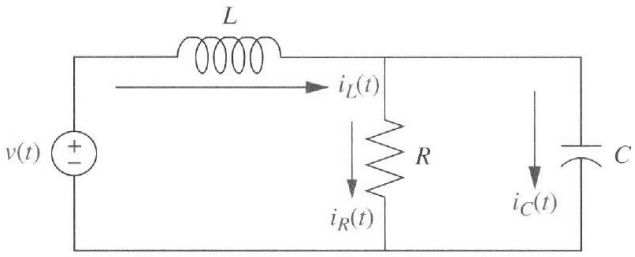
107 學年第一學期電機系博士班資格考試

現代控制理論 試題

注意事項：

1. 本試題共 3 題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間:二小時。
5. 可用計算機。

1. Consider the following circuit system.



a) (20%) If the output is $i_C(t)$, the input is $v(t)$, and the state vector is $\left[v_C(t) \quad i_L(t)\right]^T$, find the state-space representation.

b) (20%) Convert the state-space representation in (a) to the transfer function with $R = 1\Omega,\ L = 1H,\ C = 1F$.

2. Consider the state-space equation of the system

$$\begin{aligned}\dot{x}(t) &= Ax(t) + Bu(t)\\ y(t) &= Cx(t)\end{aligned},$$

where $A = \begin{bmatrix} 0 & 1 \\ 0 & -2 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 4 \end{bmatrix}, C = \begin{bmatrix} 1 & 0 \end{bmatrix}$.

An observer-based state feedback control is employed to stabilize the system.

a) (15%) Choose the state feedback gain K to move the system poles to $-2 \pm j2\sqrt{3}$.

b) (15%) Choose the observer gain K_e to let the observer modes lie at $-8, -8$.

3. Given a system with the transfer function $\dfrac{s+1}{(s^2+2s+1)(s+2)}$.

a) (10%) Determine the degree and poles of the system.

b) (20%) Find a minimal realization. Check its controllability and observability.