

國立臺北科技大學

103 學年第一學期電機系博士班資格考試

最佳控制 試題

第一頁 共一頁

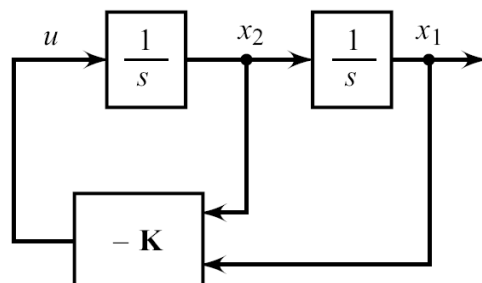
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注意事項：

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

1. (25%) Determine the optimal feedback gain matrix \mathbf{K} , such that the following performance index is minimized.

$$J = \frac{1}{2} \int_0^{\infty} (\mathbf{x}^T \mathbf{Q} \mathbf{x} + 2u^2) dt; \mathbf{Q} = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}.$$



2. (25%) Consider the system (with scalar u and x)

$$\dot{x} = u \quad x(t_0) \text{ given}$$

and with performance index $V(x(t_0), u(\cdot), t_0) = \int_{t_0}^T (u^2 + x^2) dt + x^2(T)$.

Find the optimal control law u^* .

3. (25%) Consider the plant

$$\dot{\mathbf{x}} = \begin{bmatrix} -1 & 0 \\ 1 & 0 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$$

with the performance index $J = \int_0^\infty (x_1^2 + u^2) dt$

Test whether an asymptotically stable optimal solution exists for this control problem.

4. (25%) Consider the plant

$$\dot{x} = x + v, \quad y = x + w$$

with $E[v(t)v(\tau)] = E[w(t)w(\tau)] = \delta(t - \tau)$ and v and w independent.

Suppose that at time zero, $x(0)$ is known to be zero. Design an optimal estimator.