

(1) A continuous time invariant system is described by $\ddot{y} - 6\dot{y} - 2y = \ddot{u} + 2\dot{u} - 3u$ find the controllability and observability of the model by deriving the model by observable canonical form

(2) A continuous time invariant system is described by $\ddot{y} + 6\dot{y} + 8y = \ddot{u} + 2\dot{u} - 3u$ find the controllability and observability of the model by deriving the model by Jordan form.

(3) A model has $A = \begin{bmatrix} 0 & -6 \\ 1 & -5 \end{bmatrix}$ $B = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ Find the feedback gain such that the closed loop poles are at -1 and -4

(4) A model has $A = \begin{bmatrix} 2 & 1 \\ 0 & -3 \end{bmatrix}$ $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ Find the feedback gain such that the closed loop poles are at $-3 \pm j4$