$$\underline{\dot{x}} = \overbrace{\begin{bmatrix} -3 & 1 \\ 1 & -3 \end{bmatrix}}^{A} \underline{x} + \overbrace{\begin{bmatrix} 1 \\ 2 \end{bmatrix}}^{B} u$$

$$y = \underbrace{\begin{bmatrix} 2 & 3 \end{bmatrix}}_{C} \underline{x}$$

$$T = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

$$T^{-1} = \begin{bmatrix} 1/2 & 1/2 \\ 1/2 & -1/2 \end{bmatrix}$$

$$T^{-1} A T = \underbrace{\begin{bmatrix} 1/2 & 1/2 \\ 1/2 & -1/2 \end{bmatrix}}_{T^{-1}} \underbrace{\begin{bmatrix} -3 & 1 \\ 1 & -3 \end{bmatrix}}_{A} \underbrace{\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}}_{T}$$

$$A' = \begin{bmatrix} -2 & 0 \\ 0 & -4 \end{bmatrix}$$

$$T^{-1}B = B' = \begin{bmatrix} 3/2 \\ -1/2 \end{bmatrix}$$

$$CT = C' = \begin{bmatrix} 5 & -1 \end{bmatrix}$$

$$\dot{\underline{w}} = \begin{bmatrix} -2 & 0 \\ 0 & -4 \end{bmatrix} \underline{w} + \begin{bmatrix} 3/2 \\ -1/2 \end{bmatrix} u$$

$$y = \begin{bmatrix} 5, & -1 \end{bmatrix} \underline{w}$$