Example 2

$$\frac{d\underline{w}}{dt} = \Lambda \underline{w} + T^{-1} B u$$

$$\Lambda = T^{-1} A T$$

$$\frac{d\underline{w}}{dt} = \begin{bmatrix} -1 & 0 \\ 0 & -2 \end{bmatrix} \underline{w} + \begin{bmatrix} -1 & -2 \\ 2 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} \underline{u} ; u = 1$$

$$\frac{dw_1}{dt} = -w_1 - 1 \quad \epsilon$$

$$\frac{dw_2}{dt} = -2w_2 + 2 \quad \epsilon$$

$$\underline{w}_0 = T^{-1} \underline{x}_0 = \begin{bmatrix} -1 & -2 \\ 2 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} = \begin{bmatrix} -3 \\ 4 \end{bmatrix}$$

$$w_1 = -3e^{-t} - \int_0^t e^{-(t-\tau)} d\tau$$

$$= -3e^{-t} - \left[e^{-(t-\tau)} \right]_0^t$$

$$= -3e^{-t} - \left[1 - e^{-t} \right]$$

$$= -1 - 2e^{-t}.$$

$$w_2 = 1 + 3e^{-t}.$$

Example 2

$$\frac{d\underline{w}}{dt} = \Lambda \underline{w} + T^{-1} B u$$

$$\Lambda = T^{-1} A T$$

$$\frac{d\underline{w}}{dt} = \begin{bmatrix} -1 & 0 \\ 0 & -2 \end{bmatrix} \underline{w} + \begin{bmatrix} -1 & -2 \\ 2 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} \underline{u} \; ; \; u = 1$$

$$\frac{dw_1}{dt} = -w_1 - 1 \qquad \epsilon$$

$$\frac{dw_2}{dt} = -2w_2 + 2 \qquad \epsilon$$

$$\underline{w}_0 = T^{-1} \underline{x}_0 = \begin{bmatrix} -1 & -2 \\ 2 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} = \begin{bmatrix} -3 \\ 4 \end{bmatrix}$$

$$w_1 = -3e^{-t} - \int_0^t e^{-(t-\tau)} d\tau$$

$$= -3e^{-t} - \left[e^{-(t-\tau)} \right]_0^t$$

$$= -3e^{-t} - \left[1 - e^{-t} \right]$$

$$= -1 - 2e^{-t}.$$

$$w_2 = 1 + 3e^{-t}.$$

$$\underline{x} = \underline{T}\,\underline{w}$$

$$= \begin{bmatrix} 1 & 1 \\ -1 & -1/2 \end{bmatrix} \begin{bmatrix} -1-2e^{-t} \\ 1+3e^{-2t} \end{bmatrix}$$

$$\underline{x} = \begin{bmatrix} -2e^{-t}+3e^{-2t} \\ 0.5+2e^{-t}-1.5e^{-2t} \end{bmatrix}$$

$$y = CTw + Du$$