

$$A = \begin{bmatrix} 0 & 1 \\ -25 & 0 \end{bmatrix}$$

eigen values  
eigen vectors  
modal Matrix  
state transition matrix

$$\det(\lambda I - A) = 0$$

$$\det\left(\begin{bmatrix} \lambda & 0 \\ 0 & \lambda \end{bmatrix} - \begin{bmatrix} 0 & 1 \\ -25 & 0 \end{bmatrix}\right) = 0$$

$$\det\left(\begin{bmatrix} \lambda & -1 \\ 25 & \lambda \end{bmatrix}\right) = 0$$

$$\lambda^2 + 25 = 0$$

$$\lambda^2 = -25 \quad \lambda = \sqrt{-25} = \pm 5j$$

$$\boxed{\begin{matrix} \lambda_1 = 5j \\ \lambda_2 = -5j \end{matrix}}$$

$$\lambda_1 = 5j$$

$$(\lambda_1 I - A) m_1 = 0$$

$$\begin{bmatrix} 5j & -1 \\ 25 & 5j \end{bmatrix} \begin{bmatrix} m_{11} \\ m_{12} \end{bmatrix} = 0$$

$$5j m_{11} - m_{12} = 0$$

$$25 m_{11} + 5j m_{12} = 0$$

$$5 m_{11} + j m_{12} = 0$$

$$5j m_{11} - m_{12} = 0$$

$$\boxed{m_1 = a \begin{bmatrix} 1 \\ 5j \end{bmatrix}}$$

$$\lambda_2 = -5j$$

$$(\lambda_2 I - A) m_2 = 0$$

$$\begin{bmatrix} -5j & -1 \\ 25 & -5j \end{bmatrix} \begin{bmatrix} m_{21} \\ m_{22} \end{bmatrix} = 0$$

$$-5j m_{21} - m_{22} = 0$$

$$\boxed{m_2 = b \begin{bmatrix} 1 \\ -5j \end{bmatrix}}$$

$$\Lambda = \begin{bmatrix} 5j & 0 \\ 0 & -5j \end{bmatrix}$$

$$\boxed{M = \begin{bmatrix} 1 & 1 \\ 5j & -5j \end{bmatrix}}$$

$$\underline{\Phi}'(t) = \begin{bmatrix} e^{5jt} & 0 \\ 0 & e^{-5jt} \end{bmatrix}$$

$$\underline{\Phi}(t) = M \underline{\Phi}'(t) M^{-1}$$

$$M^{-1} = M^T \quad \times$$

$$M M^T = I \quad \times$$

$$M^T M = I$$

$$\begin{bmatrix} 1 & 1 \\ 5j & -5j \end{bmatrix} \begin{bmatrix} 1 & 5j \\ 1 & -5j \end{bmatrix} = \begin{bmatrix} 2 & 0 \\ 0 & -50 \end{bmatrix}$$

$$(5j)(5j) + (-5j)(-5j)$$

$$-25 - 25 = -50$$