* Problem 3:

$$\ddot{q}(t) + (5+2\delta)\dot{q}(t) + (4+\delta)\,q(t) = 0$$

$$\Rightarrow \ddot{q}(t) = -(5+2\delta)\dot{q}(t) - (4+\delta)\,q(t)$$

Let the state vector

$$x = \begin{bmatrix} q \\ \dot{q} \end{bmatrix} \Rightarrow \dot{x} = \begin{bmatrix} \dot{q} \\ \ddot{q} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -(4+\delta) & -(5+2\delta) \end{bmatrix} \begin{bmatrix} q \\ \dot{q} \end{bmatrix}$$

Comparing $\dot{x}(t) = \bar{A}\,x(t)$

$$\dot{x}(t) = \left(\begin{bmatrix} 0 & 1 \\ -4 & -5 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ -1 & -2 \end{bmatrix} \delta(t) \right) x(t)$$

A $\qquad$ Δ

$$= A\,x(t) + k\,\phi(t)$$

$$\phi(t) = \Delta\,\psi(t)$$

$$\psi(t) = M\,x(t) + H\,\phi(t)$$

$$A = \begin{bmatrix} 0 & 1 \\ -4 & -5 \end{bmatrix} \qquad k = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$M = \begin{bmatrix} -1 & -2 \end{bmatrix} \qquad H = 0$$