WU TIANWEI

(c): $[zI - A_d + B_d K] =$

$$\begin{bmatrix} z & 0 \\ 0 & z \end{bmatrix} - \begin{bmatrix} \cos\frac{\sqrt{10}}{50} & \frac{5}{2}\sqrt{10}\sin\frac{\sqrt{10}}{50} \\ -\frac{\sqrt{10}}{25}\sin\frac{\sqrt{10}}{50} & \cos\frac{\sqrt{10}}{50} \end{bmatrix} + \begin{bmatrix} -\frac{1}{10}\cos\frac{\sqrt{10}}{50} + \frac{1}{10} \\ \frac{1}{250}\sqrt{10}\sin\frac{\sqrt{10}}{50} \end{bmatrix} [k_1 \ \ k_2]$$

$$= \begin{bmatrix} z - \cos\frac{\sqrt{10}}{50} + k_1(\frac{1}{10} - \frac{1}{10}\cos\frac{\sqrt{10}}{50}) & -\frac{5}{2}\sqrt{10}\sin\frac{\sqrt{10}}{50} + k_2(\frac{1}{10} - \frac{1}{10}\cos\frac{\sqrt{10}}{50}) \\ \frac{\sqrt{10}}{25}\sin\frac{\sqrt{10}}{50} + \frac{1}{250}\sqrt{10}\sin\frac{\sqrt{10}}{50}\cdot k_1 & z - \cos\frac{\sqrt{10}}{50} + \frac{1}{250}\sqrt{10}\sin\frac{\sqrt{10}}{50}\cdot k_2 \end{bmatrix}$$

$$\Rightarrow \alpha(z) = z^2 + [(\frac{1}{10} - \frac{1}{10}\cos\frac{\sqrt{10}}{50})k_1 + \frac{\sqrt{10}}{250}\sin\frac{\sqrt{10}}{50}\cdot k_2 - 2\cos\frac{\sqrt{10}}{50}]z +$$

$$[1 - \frac{\sqrt{10}}{250}\sin\frac{\sqrt{10}}{50}\cdot k_2 - (10\cos\frac{\sqrt{10}}{50} - \frac{1}{10})k_1] \equiv \alpha_c(z) = z^2$$

$$\Rightarrow K = \left[\frac{10\cos\frac{\sqrt{10}}{50} - 5}{1 - \cos\frac{\sqrt{10}}{50}}, \ \frac{25\sqrt{10} + 50\sqrt{10}\cos\frac{\sqrt{10}}{50}}{2\sin\frac{\sqrt{10}}{50}}\right] = [2490.8 \ \ 1873.7]$$

$$\Rightarrow x(k+1) = [A - BK]\, x(k)$$

$$= \begin{bmatrix} 0.5 & 0.125 \\ -2 & -0.5 \end{bmatrix} x(k)$$

The response to any $x(0) = [a \ \ b]^T$:

$$\begin{bmatrix} x_1(1) \\ x_2(1) \end{bmatrix} = \begin{bmatrix} 0.5 & 0.125 \\ -2 & -0.5 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 0.5a + 0.125b \\ -2a - 0.5b \end{bmatrix}$$

$$\begin{bmatrix} x_1(2) \\ x_2(2) \end{bmatrix} = \begin{bmatrix} 0.5 & 0.125 \\ -2 & -0.5 \end{bmatrix} \begin{bmatrix} 0.5a + 0.125b \\ -2a - 0.5b \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

......

$\Rightarrow x(k) = 0, \ k = 2, 3, 4, \ldots$

So, the response is clearly deadbeat.