

Robert Taylor

1. $\theta = \frac{7\pi}{4}$

$$A = \begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$$

$$= \begin{bmatrix} \cos\left(\frac{7\pi}{4}\right) & -\sin\left(\frac{7\pi}{4}\right) \\ \sin\left(\frac{7\pi}{4}\right) & \cos\left(\frac{7\pi}{4}\right) \end{bmatrix}$$

$$A = \begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{bmatrix}$$

2

$$D = \begin{bmatrix} 0.006 & 0.002 & 0.001 \\ 0.002 & 0.004 & 0.002 \\ 0.001 & 0.002 & 0.006 \end{bmatrix}$$

$$D^{-1} = \frac{\text{adj}(D)}{|D|}$$

$$|D| = 0.006(0.006(0.004) - 0.002(0.002)) - 0.002(0.006(0.002) - 0.001(0.004)) + 0.001(0.002(0.002) - 0.001(0.004))$$

$$= 1 \times 10^{-7}$$

$$\text{adj}(D) = \begin{bmatrix} 2 \times 10^{-5} & -1 \times 10^{-5} & 0 \\ -1 \times 10^{-5} & 3.5 \times 10^{-5} & -1 \times 10^{-5} \\ 0 & -1 \times 10^{-5} & 2 \times 10^{-5} \end{bmatrix}$$

$$D^{-1} = \frac{1}{1 \times 10^{-7}} \begin{bmatrix} 2 \times 10^{-5} & -1 \times 10^{-5} & 0 \\ -1 \times 10^{-5} & 3.5 \times 10^{-5} & -1 \times 10^{-5} \\ 0 & -1 \times 10^{-5} & 2 \times 10^{-5} \end{bmatrix}$$

$$= \begin{bmatrix} 200 & -100 & 0 \\ -100 & 350 & -100 \\ 0 & -100 & 200 \end{bmatrix}$$

$$f = D^{-1}y = \begin{bmatrix} 200 & -100 & 0 \\ -100 & 350 & -100 \\ 0 & -100 & 200 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 0.04 \end{bmatrix}$$

$$= \begin{bmatrix} 0 \\ -4 \\ 8 \end{bmatrix}$$

Point 1

Point 2

Point 3

$$3. \quad p = \begin{bmatrix} -7 \\ 2 \end{bmatrix} \quad q = \begin{bmatrix} 0 \\ -6 \end{bmatrix}$$

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$$x(t) = p + t(q - p)$$

$$\begin{bmatrix} -7 \\ 2 \end{bmatrix} + t \left(\begin{bmatrix} 0 \\ -6 \end{bmatrix} - \begin{bmatrix} -7 \\ 2 \end{bmatrix} \right) \quad (t \in \mathbb{R})$$

$$= \begin{bmatrix} -7 \\ 2 \end{bmatrix} + t \begin{bmatrix} 7 \\ -8 \end{bmatrix} \quad (t \in \mathbb{R})$$

$$4. \quad \begin{bmatrix} 1 & -3 & 0 & -1 & 0 & 1 & -9 \\ 0 & 1 & 0 & 0 & -8 & 1 & 1 \\ 0 & 0 & 0 & 1 & 9 & 1 & 2 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

$$R_1 \rightarrow R_1 + 3R_2$$

$$\begin{bmatrix} 1 & 0 & 0 & -1 & -24 & 1 & -6 \\ 0 & 1 & 0 & 0 & -8 & 1 & 1 \\ 0 & 0 & 0 & 1 & 9 & 1 & 2 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

$$R_1 \rightarrow R_1 + R_3$$

$$\begin{bmatrix} 1 & 0 & 0 & 0 & -15 & 1 & -4 \\ 0 & 1 & 0 & 0 & -8 & 1 & 1 \\ 0 & 0 & 0 & 1 & 9 & 1 & 2 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

$$x_1 - 15x_5 = -4$$

$$x_2 - 8x_5 = 1$$

$$x_4 + 9x_5 = 2$$