

T. GBOEKWE KENENNA

16/EN403/031

CIVIL ENGINEERING

ENG 382

Assignment 4

$$\left. \begin{aligned} 10m_1 - 2m_2 + m_3 &= 9 \\ -2m_1 + 10m_2 - 2m_3 &= 12 \\ -2m_1 - 5m_2 + 10m_3 &= 18 \end{aligned} \right\} \begin{aligned} m_1 &= 1 \\ m_2 &= 2 \\ m_3 &= 3 \end{aligned}$$

Using Jacobi

$$m_1 = \frac{2m_2 - m_3 + 9}{10} = 0.2m_2 - 0.1m_3 + 0.9$$

$$m_2 = \frac{2m_1 + 2m_3 + 12}{10} = 0.2m_1 + 0.2m_3 + 1.2$$

$$m_3 = \frac{2m_1 + 5m_2 + 18}{10} = 0.2m_1 + 0.5m_2 + 1.8$$

Matrix not $A_x = b$

$$\begin{bmatrix} m_1^{(k)} \\ m_2^{(k)} \\ m_3^{(k)} \end{bmatrix} = \begin{bmatrix} 0 & 0.2 & -0.1 \\ 0.2 & 0 & 0.2 \\ 0.2 & 0.5 & 0 \end{bmatrix} \begin{bmatrix} m_1^{(k-1)} \\ m_2^{(k-1)} \\ m_3^{(k-1)} \end{bmatrix} + \begin{bmatrix} 0.9 \\ 1.2 \\ 1.8 \end{bmatrix}$$

$$m_0 = [0; 0; 0]$$

$$m^{(0)} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

1st iteration:

$$\begin{bmatrix} m_1^{(1)} \\ m_2^{(1)} \\ m_3^{(1)} \end{bmatrix} = \begin{bmatrix} 0 & 0.2 & -0.1 \\ 0.2 & 0 & 0.2 \\ 0.2 & 0.5 & 0 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} + \begin{bmatrix} 0.9 \\ 1.2 \\ 1.8 \end{bmatrix} = \begin{bmatrix} 0.9 \\ 1.2 \\ 1.8 \end{bmatrix}$$
$$m^{(1)} = \begin{bmatrix} 0.9 \\ 1.2 \\ 1.8 \end{bmatrix}$$

2nd iteration

$$\begin{bmatrix} M_1^{(2)} \\ M_2^{(2)} \\ M_3^{(2)} \end{bmatrix} = \begin{bmatrix} 0 & 0.2 & -0.1 \\ 0.2 & 0 & 0.2 \\ 0.2 & 0.5 & 0 \end{bmatrix} \begin{bmatrix} 0.9 \\ 1.2 \\ 1.8 \end{bmatrix} + \begin{bmatrix} 0.9 \\ 1.2 \\ 1.8 \end{bmatrix}$$

$$= \begin{bmatrix} 0 + 0.18 + (-0.18) \\ 0.18 + 0 + 0.36 \\ 0.18 + 0.6 + 0 \end{bmatrix} + \begin{bmatrix} 0.9 \\ 1.2 \\ 1.8 \end{bmatrix} = \begin{bmatrix} 0.96 \\ 1.74 \\ 2.58 \end{bmatrix}$$

$$M^2 = \begin{bmatrix} 0.96 \\ 1.74 \\ 2.58 \end{bmatrix}$$

3rd iteration

$$\begin{bmatrix} M_1^{(3)} \\ M_2^{(3)} \\ M_3^{(3)} \end{bmatrix} = \begin{bmatrix} 0 & 0.2 & -0.1 \\ 0.2 & 0 & 0.2 \\ 0.2 & 0.5 & 0 \end{bmatrix} \begin{bmatrix} 0.96 \\ 1.74 \\ 2.58 \end{bmatrix} + \begin{bmatrix} 0.9 \\ 1.2 \\ 1.8 \end{bmatrix}$$

$$= \begin{bmatrix} 0 + 0.192 + (-0.258) \\ 0.192 + 0 + 0.516 \\ 0.192 + 0.87 + 0 \end{bmatrix} + \begin{bmatrix} 0.9 \\ 1.2 \\ 1.8 \end{bmatrix} = \begin{bmatrix} 0.99 \\ 1.91 \\ 2.86 \end{bmatrix}$$