

Assignment 4

Given:

$$10m_1 - 2m_2 + m_3 = 9$$

$$-2m_1 - 5m_2 + 10m_3 = 12$$

$$-2m_1 - 5m_2 + 10m_3 = 18$$

Using Jacobi's iterative method,

Converting to matrix form:

$$\begin{array}{ccc|c} 10 & -2 & 1 & m_1 \\ -2 & 10 & -2 & m_2 \\ 1 & -2 & 10 & m_3 \end{array} \rightarrow \begin{array}{ccc|c} 10 & -2 & 1 & 9 \\ -2 & 10 & -2 & 12 \\ 1 & -2 & 10 & 18 \end{array}$$

$$\text{Initial value } \rightarrow \begin{array}{ccc|c} m_1^{(0)} & 0 & 0 & 0 \\ m_2^{(0)} & 0 & 0 & 0 \\ m_3^{(0)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(1)} & 0 & 0 & 0 \\ m_2^{(1)} & 0 & 0 & 0 \\ m_3^{(1)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(2)} & 0 & 0 & 0 \\ m_2^{(2)} & 0 & 0 & 0 \\ m_3^{(2)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(3)} & 0 & 0 & 0 \\ m_2^{(3)} & 0 & 0 & 0 \\ m_3^{(3)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(4)} & 0 & 0 & 0 \\ m_2^{(4)} & 0 & 0 & 0 \\ m_3^{(4)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(5)} & 0 & 0 & 0 \\ m_2^{(5)} & 0 & 0 & 0 \\ m_3^{(5)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(6)} & 0 & 0 & 0 \\ m_2^{(6)} & 0 & 0 & 0 \\ m_3^{(6)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(7)} & 0 & 0 & 0 \\ m_2^{(7)} & 0 & 0 & 0 \\ m_3^{(7)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(8)} & 0 & 0 & 0 \\ m_2^{(8)} & 0 & 0 & 0 \\ m_3^{(8)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(9)} & 0 & 0 & 0 \\ m_2^{(9)} & 0 & 0 & 0 \\ m_3^{(9)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(10)} & 0 & 0 & 0 \\ m_2^{(10)} & 0 & 0 & 0 \\ m_3^{(10)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(11)} & 0 & 0 & 0 \\ m_2^{(11)} & 0 & 0 & 0 \\ m_3^{(11)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(12)} & 0 & 0 & 0 \\ m_2^{(12)} & 0 & 0 & 0 \\ m_3^{(12)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(13)} & 0 & 0 & 0 \\ m_2^{(13)} & 0 & 0 & 0 \\ m_3^{(13)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(14)} & 0 & 0 & 0 \\ m_2^{(14)} & 0 & 0 & 0 \\ m_3^{(14)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(15)} & 0 & 0 & 0 \\ m_2^{(15)} & 0 & 0 & 0 \\ m_3^{(15)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(16)} & 0 & 0 & 0 \\ m_2^{(16)} & 0 & 0 & 0 \\ m_3^{(16)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(17)} & 0 & 0 & 0 \\ m_2^{(17)} & 0 & 0 & 0 \\ m_3^{(17)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(18)} & 0 & 0 & 0 \\ m_2^{(18)} & 0 & 0 & 0 \\ m_3^{(18)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(19)} & 0 & 0 & 0 \\ m_2^{(19)} & 0 & 0 & 0 \\ m_3^{(19)} & 0 & 0 & 0 \end{array}$$

$$\begin{array}{ccc|c} m_1^{(20)} & 0 & 0 & 0 \\ m_2^{(20)} & 0 & 0 & 0 \\ m_3^{(20)} & 0 & 0 & 0 \end{array}$$

First iteration:

Dividing throughout by 10 i.e. eqn ①, we have

$$m_1 - 0.2m_2 + 0.1m_3 = 0.9$$

$$= 0.2m_1 + m_2 - 0.1m_3 = 0.15$$

$$\begin{array}{ccc|c} \rightarrow & 0 & 0.2 & -0.1 & 0.9 \\ 0.2 & 0 & 0.2 & 1.2 & + 1.2 \\ 0.2 & 0.5 & 0 & 1.8 & 1.8 \end{array}$$

$$\begin{array}{ccc|c} \rightarrow & 0 & 0.24 & -0.18 & 0.9 \\ 0.18 & 0 & 0.36 & 1.2 & + 1.2 \\ 0.18 & 0.60 & 0 & 1.8 & 1.8 \end{array}$$

$$\begin{array}{ccc|c} \rightarrow & 0 & 0.2 & -0.1 & 0.96 \\ 0.2 & 0 & 0.2 & 1.74 & + 1.2 \\ 0.2 & 0.5 & 0 & 2.58 & 1.8 \end{array}$$

$$\begin{array}{ccc|c} \rightarrow & 0 & 0.2 & -0.1 & 0.96 \\ 0.2 & 0 & 0.2 & 1.74 & + 1.2 \\ 0.2 & 0.5 & 0 & 2.58 & 1.8 \end{array}$$

$$\begin{array}{ccc|c} \rightarrow & 0 & 0.348 & -0.258 & 0.9 \\ 0.192 & 0 & 0.516 & 1.2 & + 1.2 \\ 0.192 & 0.870 & 0 & 1.8 & 1.8 \end{array}$$

$$\begin{array}{ccc|c} \therefore m_1 = 0.990 & & & 0.990 \\ m_2 = 1.908 & & & 1.908 \\ m_3 = 2.862 & & & 2.862 \end{array}$$