Computational Numerical Methods

CS 374

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Ex Use Gauss Elimination method (Naive & Modified form)

to solve the matrix equation $Ax = b$ where

$$A = \begin{bmatrix} 2 & 1 & -1 \\ 4 & 0 & -1 \\ -8 & 2 & 2 \end{bmatrix} \qquad b = \begin{bmatrix} 6 \\ 6 \\ -8 \end{bmatrix}$$

Soln

$$x = \begin{bmatrix} 1 \\ 2 \\ -2 \end{bmatrix}$$

$$\left[\begin{array}{ccc|c} 2 & 1 & -1 & 6 \\ 4 & 0 & -1 & 6 \\ -8 & 2 & 2 & -8 \end{array}\right] \longrightarrow \left[\begin{array}{ccc|c} 2 & 1 & -1 & 6 \\ 0 & -2 & 1 & -6 \\ 0 & 6 & -2 & 16 \end{array}\right] \longrightarrow$$

$$\left[\begin{array}{ccc|c} 2 & 1 & -1 & 6 \\ 0 & -2 & 1 & -6 \\ 0 & 0 & 1 & -2 \end{array}\right]$$

$x_3 = -2$, $-2x_2 + x_3 = -6$

$x_2 = 2$

$x_1 = 1$

$$0.729x_1 + 0.81x_2 + 0.9x_3 = 0.6867$$

$$x_1 + x_2 + x_3 = 0.8338$$

$$1.331x_1 + 1.21x_2 + 1.1x_3 = 1$$

↓

Use 4 decimal places. Rounding.

$$0.729x_1 + 0.81x_2 + 0.9x_3 = 0.6867.$$

$$0 - 0.1111x_2^{(1)} - 0.2345x_3^{(1)} = -0.10082$$

$$0 - 0.2688x_2^{(1)} - 0.5432x_3^{(1)} = -0.2537$$

↓

$$-0.5432 - (-0.2345) \times \frac{0.2688}{0.11111}$$

$$1 - \frac{.81}{.729}$$

$$1 - \frac{1.331}{0.729}$$

$$0.729x_1 + 0.81x_2 + 0.9x_3 = 0.6867$$

$$-0.1111x_2^{(1)} - 0.2345x_3^{(1)} = -0.1082$$

$$0 + 0.0241x_3^{(2)} = 0.0080$$

$$x_3 = \frac{0.0080}{0.0241} = 0.3319$$

$$x_2 = \frac{-0.1082 + (0.2345 \times 0.3319)}{-0.1111}$$

$$= 0.2736$$

$$x_1 = \frac{0.6867 - 0.9 \times 0.3319 - 0.81 \times 0.2736}{0.729}$$

$$= 0.2282$$

Try with Modified. Gauss elimination