UNIT 3 SOLUTION OF EQUATIONS
GAUSS JACOBI METHOD

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Gauss – Jacobi Method

Let the system of simultaneous equations be

$$\left.\begin{aligned} a_1x + b_1y + c_1z &= d_1 \\ a_2x + b_2y + c_2z &= d_2 \\ a_3x + b_3y + c_3z &= d_3 \end{aligned}\right\} \rightarrow (1)$$

Assume, $|a_1| > |b_1| + |c_1|$

$|b_2| > |a_2| + |c_2|$

$|c_3| > |a_3| + |c_3|$

i.e. The diagonal elements should dominant. so that the iteration process can.

This system of equations can also be written as

$$\left.\begin{aligned} x &= \frac{1}{a_1}(d_1 - b_1y - c_1z) \\ y &= \frac{1}{b_2}(d_2 - a_2x - c_2z) \\ z &= \frac{1}{c_3}(d_3 - a_3x - b_3y) \end{aligned}\right\} \rightarrow (2)$$

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Solve the following system by Gauss Jacobi method

$10x - 5y - 2z = 3$

$4x - 10y + 3z = -3$

$x + 6y + 10z = -3$

Soln: $\because |10| > |-5| + |-2|$

$|-10| > |4| + |3|$

$|10| > |1| + |6|$

Since the diagonal elements are dominant, the iteration process can be applied.

The given system can be written as,

$x = \frac{1}{10}(3 + 5y + 2z)$

$y = \frac{1}{-10}(3 + 4x + 3z)$

$z = \frac{1}{10}(-3 - x - 6y)$

$x = \frac{1}{10}(3+5y+2z)$	$y = \frac{-1}{10}(3+4x+3z)$	$z = \frac{1}{10}(-3-x-6y)$
$x_1 = 0.3$	$y_1 = 0.3$	$z_1 = -0.3$
$x_2 = 0.39$	$y_2 = 0.33$	$z_2 = -0.51$
$x_3 = 0.363$	$y_3 = 0.303$	$z_3 = -0.537$
$x_4 = 0.3441$	$y_4 = 0.2841$	$z_4 = -0.5181$
$x_5 = 0.3384$	$y_5 = 0.2822$	$z_5 = -0.5048$
$x_6 = 0.3401$	$y_6 = 0.2829$	$z_6 = -0.5031$
$x_7 = 0.3413$	$y_7 = 0.2751$	$z_7 = -0.5043$
$x_8 = 0.3416$	$y_8 = 0.2852$	$z_8 = -0.5051$
$x_9 = 0.3415$	$y_9 = 0.28511$	$z_9 = -0.5052$
$x_{10} = 0.34148$	$y_{10} = 0.28504$	$z_{10} = -0.5052$

$x \simeq 0.3415$, $y \simeq 0.2850$ $z \simeq -0.5052$

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② Solve the following using gauss jacobi's iteration method : $30x - 2y + 3z = 75$

$x + 17y - 2z = 48$

$x + y + 9z = 15$

Soln: $a_1: |30| > |-2| + |3|$

$b_2: |17| > |1| + |-2|$

$c_3: |9| > |1| + |1|$

Since the diagonal elements are dominant. The iteration process is applied here:

The given system can be written as:

$$x = \frac{1}{30}[75 + 2y - 3z]$$

$$y = \frac{1}{17}[48 - x + 2z]$$

$$z = \frac{1}{9}[15 - x - y]$$

$x = \frac{1}{30}[75+2y-3z]$	$y = \frac{1}{17}[48-x+2z]$	$z = \frac{1}{9}[15-x-y]$
$x_1 = 2.5$	$y_1 = 2.8235$	$z_1 = 1.6667$
$x_2 = 2.5217$	$y_2 = 2.8725$	$z_2 = 1.0751$
$x_3 = 2.5839$	$y_3 = 2.8016$	$z_3 = 1.0673$
$x_4 = 2.5800$	$y_4 = 2.7971$	$z_4 = 1.0682$
$x_5 = 2.5796$	$y_5 = 2.7974$	$z_5 = 1.0692$
$x_6 = 2.5795$	$y_6 = 2.7975$	$z_6 = 1.0692$
$x_7 = 2.5795$	$y_7 = 2.7975$	$z_7 = 1.0692$

$\therefore \quad x = 2.5795, \; y = 2.7975, \; z = 1.0692$