INGENIERIA EN SISTEMAS COMPUTACIONALES

METODOS NUMERICOS

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5501

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Ejercicio

De los siguientes Sistemas de ecuaciones, obtener la solucion realizando:

- 4 iteraciones completas utilizando Jacobi
- 4 iteraciones completas utilizando Gauss-Siedel

Jacobi:

$$9x + 2y - z = -2$$
$$7x + 8y + 5z = 3$$
$$3x + 4y - 10z = 6$$

$x = -2/9 - 2y/9 + z/9 = -0.22 - 0.22y + 0.11z$
$y = 3/8 - 7x/8 - 5z/8 = 0.375 - 0.875x - 0.625z$
$z = -3/5 + 3x/10 + 2y/5 = -0.6 + 0.3x + 0.4y$

$x = -0.22 - 0.22y + 0.11z$ $\quad x_0 = 0$
$y = 0.375 - 0.875x - 0.625z$ $\quad y_0 = 0$
$z = -0.6 + 0.3x + 0.4y$ $\quad z_0 = 0$

$x_1 = -0.22 - 0.22y + 0.11z = -0.22$ ← 1er Iteracion
$y_1 = 0.375 - 0.875x - 0.625z = 0.375$
$z_1 = -0.6 + 0.3x + 0.4y = -0.6$

$x_2 = -0.22 - 0.22y_1 + 0.11z_1 = -0.2035$ ← 2da Iteracion
$y_2 = 0.375 - 0.875x_1 - 0.625z_1 = 0.1925$
$z_2 = -0.6 + 0.3x_1 + 0.4y_1 = -0.516$

$x_3 = -0.22 - 0.22y_2 + 0.11z_2 = -0.22 - 0.22(-0.2035) + 0.11(-0.1925)$
$y_3 = 0.375 - 0.875x_2 - 0.625z_2 = 0.375 - 0.875(-0.2035) - 0.625(-0.516)$
$z_3 = -0.6 + 0.3x_2 + 0.4y_2 = -0.6 + 0.3(-0.2035) + 0.4(-0.1925)$

$x_3 = -0.285945$ ← 3ra Iteracion
$y_3 = -0.1259625$
$z_3 = -0.73805$

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$x_4 = -0.22 - 0.22y_3 + 0.11z_3$ $= -0.22 - 0.22(-0.1255625) + 0.11(-0.73805)$
$y_4 = 0.375 - 0.875x_3 - 0.625z_3$ $= 0.375 - 0.875(-0.285945) - 0.625(-0.73805)$
$z_4 = -0.6 + 0.3x_3 + 0.4y_3$ $= -0.6 + 0.3(-0.285945) + 0.4(-0.1255625)$

$x_4 = -0.32880925$
$y_4 = -0.336966$
$z_4 = -0.7360085$ ← 4ta Iteracion

2)

$5x + 2y = 12$
$-x + 10y = 8$

$x = 12/5 + 2y/5 = 2.4 + 0.4y$
$y = 8/10 + x/10 = 0.8 + 0.1x$

$x_0 = 0$
$y_0 = 0$

$x_1 = 2.4 + 0.4y = 2.4 + 0.4(0) = 2.4$ ← 1er Iteracion
$y_1 = 0.8 + 0.1x = 0.8 + 0.1(0) = 0.8$

$x_2 = 2.4 + 0.4y_1 = 2.4 + 0.4(0.8)$ $x_2 = 2.72$ ← 2do Iteracion
$y_2 = 0.8 + 0.1x_1 = 0.8 + 0.1(2.4)$ $y_2 = 1.04$

$x_3 = 2.4 + 0.4y_2 = 2.4 + 0.4(1.04)$ $x_3 = 2.816$ ← 3ra Iteracion
$y_3 = 0.8 + 0.1x_2 = 0.8 + 0.1(2.72)$ $y_3 = 1.072$

$x_4 = 2.4 + 0.4y_3 = 2.4 + 0.4(1.072)$ $x_4 = 2.8288$ ← 4to Iteracion
$y_4 = 0.8 + 0.1x_3 = 0.8 + 0.1(2.816)$ $y_4 = 1.0816$

3)

$8x + y = 4$
$2x + 5y = 3$
$x + 4z = 3$

$x = 4/8 - y/8 = 0.5 - 0.125y$
$y = 3/5 - 2x/5 = 0.6 - 0.4x$
$z = 3/4 - x/4 = 0.75 - 0.25x$

$x_0 = 0$
$y_0 = 0$
$z_0 = 0$

$x_1 = 0.5 - 0.125(0) = 0.5$ $x_1 = 0.5$
$y_1 = 0.6 - 0.4(0) = 0.6$ $y_1 = 0.6$ ← 1er Iteracion
$z_1 = 0.75 - 0.25x(0) = 0.75$ $z_1 = 0.75$

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$x_2 = 0.5 - 0.125y_1 = 0.5 - 0.125(0.6) = 0.425$
$y_2 = 0.6 - 0.4x_1 = 0.6 - 0.4(0.5) = 0.4$
$z_2 = 0.75 - 0.25x_1 = 0.75 - 0.25(0.5) = 0.625$

$x_2 = 0.425$ ← 2da Iteracion
$y_2 = 0.4$
$z_2 = 0.625$

$x_3 = 0.5 - 0.125y_2 = 0.5 - 0.125(0.4) = 0.45$
$y_3 = 0.6 - 0.4x_2 = 0.6 - 0.4(0.425) = 0.43$
$z_3 = 0.75 - 0.25x_2 = 0.75 - 0.25(0.425) = 0.64375$

$x_3 = 0.45$ ← 3ra Iteracion
$y_3 = 0.43$
$z_3 = 0.64375$

$x_4 = 0.5 - 0.125y_3 = 0.5 - 0.125(0.43) = 0.44625$
$y_4 = 0.6 - 0.4x_3 = 0.6 - 0.4(0.45) = 0.42$
$z_4 = 0.75 - 0.25x_3 = 0.75 - 0.25(0.45) = 0.6375$

$x_3 = 0.44625$ ← 4ta Iteracion
$y_3 = 0.42$
$z_3 = 0.6375$

4) $6x + 2y + z = 22$
$-x + 8y + 2z = 20$
$x - y + 6z = 23$

$x = 22/6 - y/3 - z/6 = 3.6 - 0.33y - 0.16z$
$y = 5/2 + x/8 - z/4 = 2.5 + 0.125x - 0.25z$
$z = 23/6 - x/6 + y/6 = 3.83 - 0.16x + 0.16y$

$x_0 = 0$
$y_0 = 0$
$z_0 = 0$

$x_1 = 3.6 - 0.33y - 0.16z = 3.6 - 0.33(0) - 0.16(0) = 3.6$
$y_1 = 2.5 + 0.125x - 0.25z = 2.5 + 0.125(0) - 0.25(0) = 2.5$
$z_1 = 3.83 - 0.16x + 0.16y = 3.83 - 0.16(0) + 0.16(0) = 3.83$

$x_1 = 3.6$ ← 1er. Iteracion
$y_1 = 2.5$
$z_1 = 3.83$

$x_2 = 3.6 - 0.33y_1 - 0.16z_1 = 3.6 - 0.33(2.5) - 0.16(3.83) = 2.1622$
$y_2 = 2.5 + 0.125x_1 - 0.25z_1 = 2.5 + 0.125(3.6) - 0.25(3.83) = 1.9925$
$z_2 = 3.83 - 0.16x_1 + 0.16y_1 = 3.83 - 0.16(3.6) + 0.16(2.5) = 3.654$

$x_2 = 2.1622$ ← 2da Iteracion
$y_2 = 1.9925$
$z_2 = 3.654$

$x_3 = 3.6 - 0.33y_2 - 0.16z_2 = 3.6 - 0.33(1.9925) - 0.16(3.654) = 2.367836$
$y_3 = 2.5 + 0.125x_2 - 0.25z_2 = 2.5 + 0.125(2.1622) - 0.25(3.654) = 1.856775$
$z_3 = 3.83 - 0.16x_2 + 0.16y_2 = 3.83 - 0.16(2.1622) + 0.16(1.9925) = 3.802848$

x_3 ← 3ra Iteracion
y_3
z_3

$x_4 = 3.6 - 0.33y_3 - 0.16z_3 = 3.6 - 0.33(1.856775) - 0.16(3.802848) = 2.37880857$
$y_4 = 2.5 + 0.125x_3 - 0.25z_3 = 2.5 + 0.125(2.367836) - 0.25(3.802848) = 1.844017375$
$z_3 = 3.83 - 0.16x_3 + 0.16y_3 = 3.83 - 0.16(2.367835) + 0.16(1.856775) = 3.7498304$

$x_4 = 2.37880857$ ← 4ta Iteracion
$y_4 = 1.844017375$
$z_4 = 3.7498304$