Lad. 13 / Zestaw 3 Kinga Kondraciuk

$t \in \langle 0, 0{,}5 \rangle$

$$y_n = y_{n-1} + h \cdot f\left(x_{n-1} + \frac{h}{2}, \; y_{n-1} \frac{h}{2} f(x_{n-1}, y_{n-1})\right)$$

$$\frac{dy_1}{dt} = c_1 y_1 - a_{12} y_1 y_2 = y_1 (1 - 0{,}0025 y_2)$$

$$\frac{dy_2}{dt} = -c_2 y_2 + a_{21} y_1 y_2 = y_2 (-1 + 0{,}0025 y_1)$$

Dla $h = 0{,}5$

$y_1(0) = 400$

$y_2(0) = 80$

$y_1 0 = 400$

$y_2 0 = 80$

$f_1(400, 80) = 400(1 - 0{,}005 \cdot 80) = 240$

$f_2(400, 80) = 80(-1 + 0{,}0025 \cdot 400) = 0$

$$y_1 = y_0 + h \cdot f\left(x_0 + \frac{h}{2},\ y_0 + \frac{h}{2} \cdot f(y_0)\right)$$

$$y_0 + \frac{h}{2} \cdot f(y_0) = \begin{bmatrix} 400 \\ 80 \end{bmatrix} + 0{,}25 \begin{bmatrix} 240 \\ 0 \end{bmatrix} = \begin{bmatrix} 460 \\ 80 \end{bmatrix}$$

$$f_1(460{,}80) = 460\,(1 - 0{,}005 \cdot 80) = 276$$

$$f_2(460{,}80) = 80\,(-1 + 0{,}0025 \cdot 460) = 12$$

$$y_1 = \begin{bmatrix} 400 \\ 80 \end{bmatrix} + 0{,}5 \begin{bmatrix} 276 \\ 12 \end{bmatrix} = \begin{bmatrix} 538 \\ 86 \end{bmatrix}$$

$$y_1(0{,}5) = 538$$

$$y_2(0{,}5) = 86$$

Dla $h = 0,25$

$f_1(400, 80) = 240$

$f_2(400, 80) = 0$

$$y_0 + \frac{h}{2} f(y_0) = \begin{bmatrix} 400 \\ 80 \end{bmatrix} + 0,125 \begin{bmatrix} 240 \\ 0 \end{bmatrix} = \begin{bmatrix} 430 \\ 80 \end{bmatrix}$$

$f_1(430, 80) = 258$

$f_2(430, 80) = 6$

$$y_1 + \frac{h}{2} f(y_1) = \begin{bmatrix} 400 \\ 80 \end{bmatrix} + 0,25 \begin{bmatrix} 258 \\ 6 \end{bmatrix} = \begin{bmatrix} 464,5 \\ 81,5 \end{bmatrix}$$

$y_1(0,25) = 464,5$

$y_2(0,25) = 81,5$

$f_1(464,5, 81,5) = 275,2$

$f_2(464,5, 81,5) = 13,14$

$$y_{\bullet 1} + \frac{h}{2} f(y_1) = \begin{bmatrix} 464,5 \\ 81,5 \end{bmatrix} + 0,125 \begin{bmatrix} 275,2 \\ 13,14 \end{bmatrix} = \begin{bmatrix} 498,9 \\ 83,14 \end{bmatrix}$$

$f_1(498,9) = 291,5$

$f_2(83,14) = 20,56$

$$y_2 + \frac{h}{2} f(y_2) = \begin{bmatrix} 464,5 \\ 81,5 \end{bmatrix} + 0,25 \begin{bmatrix} 291,5 \\ 20,56 \end{bmatrix} = \begin{bmatrix} 537,4 \\ 86,64 \end{bmatrix}$$

$y_1(0,5) = 537,4$

$y_2(0,5) = 86,64$