Расчетное задание №6

Вариант №22

***Условие задания***

Решить систему нелинейных уравнений методом Ньютона с погрешностью $10^{-4}$. Начальное приближение найти графически.

$\left\{\begin{matrix}tg\left(x^{\left(1\right)}x^{\left(2\right)}+0,1\right)=x^{\left(1\right)}^{2}\\0,9\left(x^{\left(1\right)}\right)^{2}+2\left(x^{\left(2\right)}\right)^{2}=1\end{matrix}\right.$

***Решение***



(Для построения графика использована бесплатная программа Graph версия 4.4.2)

Начальное приближение: $x^{\left(1\right)}=0,7; x^{\left(2\right)}=0,5$

Построим матрицу Якоби:

$\frac{∂F}{∂x}=\left(\begin{matrix}\frac{x^{\left(2\right)}}{cos^{2}\left(x^{\left(1\right)}x^{\left(2\right)}+0.1\right)}-2x^{\left(1\right)}&\frac{x^{\left(1\right)}}{cos^{2}\left(x^{\left(1\right)}x^{\left(2\right)}+0.1\right)}\\1,8x^{\left(1\right)}&4x^{\left(2\right)}\end{matrix}\right)$

1) $\left\{\begin{matrix}\left(\frac{0,5}{cos^{2}\left(0,45\right)}-1,4\right)ε\_{0}^{\left(1\right)}+\frac{0,7}{cos^{2}\left(0,45\right)}ε\_{0}^{\left(2\right)}=-\left(tg0,45-0,49\right)\\1,26ε\_{0}^{\left(1\right)}+2ε\_{0}^{\left(2\right)}=-\left(0,441+0,5-1\right)\end{matrix}\right.⇔$

$⇔\left\{\begin{matrix}-0,783328901ε\_{0}^{\left(1\right)}+0,863339537ε\_{0}^{\left(2\right)}=0,006944934\\ε\_{0}^{\left(1\right)}=-1,587301587ε\_{0}^{\left(2\right)}+0,046825397\end{matrix}\right.⇔$

$⇔\left\{\begin{matrix}1,243379208ε\_{0}^{\left(2\right)}-0,036679687+0,863339537ε\_{0}^{\left(2\right)}=0,006944934\\ε\_{0}^{\left(1\right)}=-1,587301587ε\_{0}^{\left(2\right)}+0,046825397\end{matrix}\right.⇔$

$⇔\left\{\begin{matrix}ε\_{0}^{\left(2\right)}=0,020707378\\ε\_{0}^{\left(1\right)}=0,013956543\end{matrix}\right.⇒\left\{\begin{matrix}x^{\left(1\right)}=0,713956543\\x^{\left(2\right)}=0,520707378\end{matrix}\right.$

2) $\left\{\begin{matrix}\left(\frac{0,520707378}{cos^{2}\left(0,471762439\right)}-1,427913086\right)ε\_{0}^{\left(1\right)}+\frac{0,713956543}{cos^{2}\left(0,471762439\right)}ε\_{0}^{\left(2\right)}=-\left(tg0,471762439-0,509733945\right)\\1,285121777ε\_{0}^{\left(1\right)}+2,082829512ε\_{0}^{\left(2\right)}=-\left(0,458760550+0,542272347-1\right)\end{matrix}\right.⇔$

$⇔\left\{\begin{matrix}-0,771671397ε\_{0}^{\left(1\right)}+0,899791450ε\_{0}^{\left(2\right)}=-0,000451141\\ε\_{0}^{\left(1\right)}=-1,620725404ε\_{0}^{\left(2\right)}-0,000803734\end{matrix}\right.⇔$

$⇔\left\{\begin{matrix}1,250667436ε\_{0}^{\left(2\right)}+0,000620218+0,899791450ε\_{0}^{\left(2\right)}=-0,000451141\\ε\_{0}^{\left(1\right)}=-1,620725404ε\_{0}^{\left(2\right)}-0,000803734\end{matrix}\right.⇔$

$⇔\left\{\begin{matrix}ε\_{0}^{\left(2\right)}=-0,000498200\\ε\_{0}^{\left(1\right)}=0,000003711\end{matrix}⇒\left\{\begin{matrix}x^{\left(1\right)}=0,713960254\\x^{\left(2\right)}=0,520209178\end{matrix}\right.\right.$

3) $\left\{\begin{matrix}\left(\frac{0,520209178}{cos^{2}\left(0,471408676\right)}-1,427920508\right)ε\_{0}^{\left(1\right)}+\frac{0,713960254}{cos^{2}\left(0,471408676\right)}ε\_{0}^{\left(2\right)}=-\left(tg0,471408676-0,509739244\right)\\1,285128457ε\_{0}^{\left(1\right)}+2,080836712ε\_{0}^{\left(2\right)}=-\left(0,458765319+0,541235178-1\right)\end{matrix}\right.⇔$

$⇔\left\{\begin{matrix}-0,772543206ε\_{0}^{\left(1\right)}+0,899471529ε\_{0}^{\left(2\right)}=0,000000079\\ε\_{0}^{\left(1\right)}=-1,619166318ε\_{0}^{\left(2\right)}-0,000000386\end{matrix}\right.⇔$

$⇔\left\{\begin{matrix}1,250875938ε\_{0}^{\left(2\right)}+0,000000298+0,899471529ε\_{0}^{\left(2\right)}=0,000000079\\ε\_{0}^{\left(1\right)}=-1,619166318ε\_{0}^{\left(2\right)}-0,000000386\end{matrix}\right.⇔$

$⇔\left\{\begin{matrix}ε\_{0}^{\left(2\right)}=-0,000000102\\ε\_{0}^{\left(1\right)}=-0,000000221\end{matrix}\right.⇒\left\{\begin{matrix}x^{\left(1\right)}=0,713960033\\x^{\left(2\right)}=0,520208957\end{matrix}\right.$

***Ответ***

$\left\{\begin{matrix}x^{\left(1\right)}=0,713960033\\x^{\left(2\right)}=0,520208957\end{matrix}\right.$