Book Mechanical Engineering

19th March 2019 ENG 882

Assignment 2

If the Maximum percentage absolute error is desired to be $1E{-}9$ Using the Newton-Raphson Iteration method and Initial guess of 0.5, find the root of the function In the given Equation (1.1)

i) Manually (ii) With the aid of MATLAB $f(x) = e^{-0.5x}(4-x) - 2$

Solution

i) $f(x) = e^{-0.5x}(4-x) - 2$

$f'(x) =$, let $u = e^{-0.5x}$; $v = (4-x)$

$du = -0.5e^{-0.5x}$ $dv = -1$

$f'(x) = udv + vdu$

$= e^{-0.5x}(-1) + (4-x)(-0.5e^{-0.5x})$

$x_0 = 0.5$ (Initial guess)

General Newton-Raphson's formular

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$f(x_0) = f(0.5) = 0.7258027407$

$f'(x_0) = f'(0.5) = -2.141702153$

$$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 0.8388906061 \text{ (Root 1)}$$

$f(x_1) = 0.07814929779$

$f'(x_1) = -1.696486032$

$$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)} = 0.8849560003 \text{ (Root 2)}$$

$f(x_2) = 1.286575203 \times 10^{-3}$

$f'(x_2) = -1.643060762$

$$x_3 = x_2 - \frac{f(x_2)}{f'(x_2)} = 0.8857086056 \text{ (Root 3)}$$