

Michael Shallooqwa

16/Eng01/019

Chemical Engineering

Eng 382 assignment 2

Given; absolute error =  $1E-9$

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

$$x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$$

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

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

$$x_{i+1} = x_i - \frac{e^{-0.5x} (4-x) - 2}{0.5e^{-0.5x} (x-4) - e^{-0.5x}}$$

$$1) \quad x_1 = 0.5 - \frac{e^{-0.5 \times 0.5} (4 - 0.5) - 2}{0.5e^{-0.5 \times 0.5} (0.5 - 4) - e^{-0.5 \times 0.5}} = 0.838890606$$

$$\% \text{ error, } E_a = \left( \frac{x_{i+1} - x_i}{x_{i+1}} \right) \times 100$$

$$= \left( \frac{0.838890606 - 0.5}{0.838890606} \right) \times 100 = 40.39747299$$

$$2) \quad x_2 = 0.838890606 - \frac{e^{-0.5 \times 0.838890606} (4 - 0.838890606) - 2}{0.5e^{-0.5 \times 0.838890606} (0.838890606 - 4) - e^{-0.5 \times 0.838890606}}$$
$$= 0.884956$$

$$\% \text{ error} = \left( \frac{0.884956 - 0.838890606}{0.884956} \right) \times 100 = 5.2054$$

$$3) \quad x_3 = 0.884956 - \frac{e^{-0.5 \times 0.884956} (4 - 0.884956) - 2}{0.5e^{-0.5 \times 0.884956} (0.884956 - 4) - e^{-0.5 \times 0.884956}}$$
$$= 0.88571$$

$$\% \text{ error} = \left( \frac{0.88571 - 0.884956}{0.88571} \right) \times 100 = 0.084974$$

$$x_4 = 0.88571 - \frac{e^{-0.5 \times 0.88571} (4 - 0.88571) - 2}{0.5 e^{-0.5 \times 0.88571} (0.88571 - 4) - e^{-0.5 \times 0.88571}}$$

$$= \cancel{0.88571} = 0.885708802$$

$$\% \text{ error} = \left( \frac{0.885708802 - 0.8857086071}{0.885708802} \right) \times 100 = 2.200497 \times 10^{-5}$$

$$x_5 = 0.885708802 - \frac{e^{-0.5 \times 0.885708802} (4 - 0.885708802) - 2}{0.5 e^{-0.5 \times 0.885708802} (0.885708802 - 4) - e^{-0.5 \times 0.885708802}}$$

$$= 0.885708802$$

$$\% \text{ error} = \left( \frac{0.885708802 - 0.885708802}{0.885708802} \right) \times 100$$

$$= 0\%$$

i	x	$E_a$ (% Error)
0	0.5	0
1	0.838890606	40.39747299
2	0.8849559809	5.205386019
3	0.8857086071	0.08497447061
4	0.885708802	0