ISTEN605/008
ENEH CHISOM KELVIN
MECHATRONICS
ENG 382 ASSIGNMENT 2

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

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

Recall $x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)} = x_i - \left[\frac{e^{-0.5x}(4-x)-2}{-0.5e^{-0.5x}(4-x)-e^{-0.5x}}\right]$

For $i=0$, $x = 0.5$

$x_{i+1} = 0.5 - \left[\frac{e^{-0.5(0.5)}(4-0.5)-2}{-0.5e^{-0.5(0.5)}(4-0.5)-e^{-0.5(0.5)}}\right]$

$= 0.8389$

For $i=1$, $x = 0.8389$

$x_{i+1} = 0.8389 - \left[\frac{e^{-0.5(0.8389)}(4-0.8389)-2}{-0.5e^{-0.5(0.8389)}(4-0.8389)-e^{-0.5(0.8389)}}\right]$

$= 0.8850$

For $i=2$, $x = 0.8850$

$x_{i+1} = 0.8850 - \left[\frac{e^{-0.5(0.8850)}(4-0.8850)-2}{-0.5e^{-0.5(0.8850)}(4-0.8850)-e^{-0.5(0.8850)}}\right]$

$= 0.8857$

For $i=3$, $x = 0.8857$

$x_{i+1} = 0.8857 - \left[\frac{e^{-0.5(0.8857)}(4-0.8857)-2}{-0.5e^{-0.5(0.8857)}(4-0.8857)-e^{-0.5(0.8857)}}\right]$

$= 0.8857$

for $i=4$, $x = 0.8857$

for $i=5$, $x = 0.8857$

$$\% \text{ error tolerance} = \left[\frac{x_{i+1} - x_i}{x_{i+1}}\right] \times 100$$

for $i=0$, $x = 0.5$ % error = 100%

for $i=1$, $x = 0.8389$

$$\% \text{ error tolerance} = \left[\frac{0.8389 - 0.5}{0.8389}\right] \times 100$$

$$= \underline{40.39}\ \%$$

for $i=2$, $x = 0.8850$

$$\% \text{error tolerance} = \left|\frac{0.8850 - 0.8389}{0.8850}\right| \times 100$$

$$= \underline{5.28\ \%}$$

for $i=3$, $x = 0.8857$

$$\% \text{ error tolerance} = \left|\frac{0.8857 - 0.8850}{0.8857}\right| \times 100$$

$$= \underline{0.079\ \%}$$

for $i=4$, $x = 0.8857$

$$\% \text{ error tolerance} = \left|\frac{0.8857 - 0.8857}{0.8857}\right| \times 100$$

$$= 0\%$$

for i=5, $x_i = 0.8857$

% error tolerance $= \left| \frac{0.8857 - 0.8857}{0.8857} \right| \times 100$

$= 0\%$

i	x_i	% Error tolerance
0	0.5	100
1	0.8389	40.39
2	0.8850	5.38
3	0.8857	0.079
4	0.8857	0
5	0.8857	0

② $f_0 = \frac{0.3v^2}{500 + (6v)^3} - 0.02v$

$f_\Delta = mg$ m=35kg, g=9.8m/s

$f_0 = 9.8 \times 3.5 = 34.3$

Substitute

$34.3 = \frac{0.3v^2}{500 + (6v)^3} - 0.02v$

$0 = \frac{0.3v^2}{500 + (6v)^3} - 0.02v - 34.3$

$$f(v) = \frac{0.3v^2}{500 + (\ln v)^3} - 0.02v - 34.3$$

$f'(v) = ?$

$$\frac{0.3v^2}{500 + (\ln v)^3}$$

From Quotient rule: $\frac{u'v - v'u}{v^2}$

$u = 0.3v^2$

$u' = 0.6v$

$v = 500 + (\ln v)^3$

$v' = \frac{3(\ln v)^2}{v}$

$$= \frac{0.6v(500 + (\ln v)^3) - 0.3v^2\left(3\left(\frac{(\ln v)^2}{v}\right)\right)}{(500 + (\ln v)^3)^2}$$

$$= \frac{300v + (\ln v)^3 0.6v - 0.9v(\ln v)^2}{500^2 + \ln v^6}$$

$$f'(v) = \frac{300v + \ln v^3(0.6v) - 0.9v(\ln v)^2}{500^2 + \ln v^6} - 0.02$$

$x_{i+1} = x_i - f(v)/f'(v)$

$$= x_i - \frac{0.3v^2}{500 + (\ln v)^3} - 0.02v - 34.3$$

$$\frac{300v + \ln v^3(0.6v) - 0.9v(\ln v)^2 - 0.02}{500^2 + \ln v^6}$$