ORIOLA MUNIRAT OMOBOLAJI

16/ENG07/024

PETROLEUM ENGINEERING

ENG 382 ASSIGNMENT V

Question 1

The dynamic model of a system is as given in Equation (1). If the initial value of the response is 1.4, using Euler’s method, obtain the dynamic response of the system, both in tabular and graphical forms, for time t = 0 – 0.5 hr with a step time of 0.1 hr with the aid of:

1. Spreadsheet
2. MATLAB

$\frac{dy}{dt}=2t+y^{2}$ (1)

$$solution$$

 h= 0.1

y0 = 1.4

t0=0

(y’)0=2t + y2

For Euler’s method

Y1= y0 + h(y’)0

Using spreadsheet

|  |  |  |
| --- | --- | --- |
| t | y | h |
| 0 | 1.4 | 0.1 |
| 0.1 | 1.596 |   |
| 0.2 | 1.870722 |   |
| 0.3 | 2.260682 |   |
| 0.4 | 2.83175 |   |
| 0.5 | 3.71363 |   |

Using MATLAB

commandwindow

clear

clc

t=0;

y=1.4;

h=0.1;

for i=1:5

 iter(i+1) =i;

t(i+1) =(t(i)+h);

y(i+1) =y(i)+h\*((2\*t(i)) +y(i)^2);

end

tablo = [iter' t' y']

tablo =

 0 0 1.4000

 1.0000 0.1000 1.5960

 2.0000 0.2000 1.8707

 3.0000 0.3000 2.2607

 4.0000 0.4000 2.8317

 5.0000 0.5000 3.7136

 Question 2

The dynamic models of oil quantities in three interconnecting tanks with one inlet and one outlet streams are as given in Equation (2)

$\left\{\begin{array}{c}\frac{dQ\_{1}}{dt}=-\frac{15}{500}Q\_{1}+\frac{5}{1000}Q\_{2}+1\\\frac{dQ\_{2}}{dt}=\frac{15}{500}Q\_{1}-\frac{18}{1000}Q\_{2}+\frac{3}{400}Q\_{3}\\\frac{dQ\_{3}}{dt}=\frac{13}{1000}Q\_{2}-\frac{13}{400}Q\_{3}\end{array}\right\}$ (2)

Q1, Q2 and Q3 are the quantities of the oil in tanks 1, 2 and 3, respectively, at any time t. If at time t = 0, Q1 = Q2 = Q3 = 0 m3, with the aid of MATLAB, taking the simulation period to be from Tnitial = 0 min to Tinal = 1200 min, plot the dynamic responses of Q1 , Q2 and Q3 on the same graph. Also, write the steady state values.

Solution

function f = ass\_5b (t, q)

f (1) =-0.03\*q (1) +0.005\*q (2) +1;

f (2) =0.03\*q (1)-0.018\*q (2) +0.0075\*q (3);

f (3) =0.013\*q (2)-0.0325\*q (3);

f=f';

commandwindow

clear

clc

close all

[t, q] =ode45('ass\_5b’, [0 1200],[0 0 0])

plot (t, q)

xlabel('t')

ylabel('q')

legend('q\_1','q\_2','q\_3')

