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16/ENGO11008

Chemical engineering

Assignment 3

ENGE 382

$$T_1 + T_2 - 2T_3 + T_4 + 3T_5 - T_6 = 4$$

$$2T_1 - T_2 + T_3 + 2T_4 + T_5 - 3T_6 = 20$$

$$T_1 + 3T_2 - 8T_3 - T_4 + 2T_5 + T_6 = -15$$

$$5T_1 + 2T_2 - T_3 - T_4 + 2T_5 + T_6 = -3$$

$$-3T_1 - T_2 + 2T_3 + 3T_4 + T_5 + 3T_6 = 16$$

$$4T_1 + 3T_2 + T_3 - 6T_4 - 3T_5 - 2T_6 = -27$$

1	1	-2	1	3	-1	T_1	40
2	-1	1	2	1	-3	T_2	20
1	3	-3	-1	2	+1	T_3	-15
5	2	-1	-1	2	+1	T_4	-3
-3	-1	2	3	1	+3	T_5	16
4	3	1	-6	-3	-2	T_6	-27

1	1	-2	1	3	-1		4
2	$-(+3/1 \times 1)$	$-1-(2/1 \times 1)$	$1-(2/1 \times 2)$	$2-(2/1 \times 1)$	$1-(2/1 \times 3)$	$-3(2/1 \times -1)$	$20-(2/1 \times 4)$
1	$-(1/1 \times 1)$	$3-(1/1 \times 1)$	$-3-(1/1 \times 2)$	$+1(1/1 \times 1)$	$2-(1/1 \times 3)$	$1-(1/1 \times -1)$	$-15-(1/1 \times 4)$
5	$-(5/1 \times 1)$	$2-(5/1 \times 1)$	$-1-(5/1 \times 2)$	$-1-(5/1 \times 1)$	$2-(5/1 \times 3)$	$1-(5/1 \times -1)$	$-3-(5/1 \times 4)$
-3	$-(3/1 \times 1)$	$-7-(3/1 \times 1)$	$2-(3/1 \times 2)$	$3-(3/1 \times 1)$	$1-(3/1 \times 3)$	$3-(3/1 \times -1)$	$16-(3/1 \times 4)$
4	$-(4/1 \times 1)$	$3-(4/1 \times 1)$	$1-(4/1 \times 2)$	$-6-(4/1 \times 1)$	$3-(4/1 \times 3)$	$-2-(4/1 \times -1)$	$-27-(4/1 \times 4)$

1	1	-2	1	3	-1	4
0	-3	5	0	-5	-1	12
0	2	-1	-2	-1	2	-19
0	-3	9	-6	-13	6	-23
0	2	-4	6	10	0	28
0	-1	9	-10	-15	2	-43

$$\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 2 - \left(\frac{2}{3} \times 3\right) & -1 - \left(\frac{2}{3} \times 5\right) & -2 - \left(\frac{2}{3} \times 0\right) & -1 - \left(\frac{2}{3} \times 3\right) & 2 - \left(\frac{2}{3} \times -1\right) & -19 - \left(\frac{2}{3} \times 12\right) \\ 0 & = 3 - \left(\frac{3}{3} \times 3\right) & 9 - \left(\frac{3}{3} \times 5\right) & -6 - \left(\frac{3}{3} \times 0\right) & -13 - \left(\frac{3}{3} \times 3\right) & 6 - \left(\frac{3}{3} \times -1\right) & -23 - \left(\frac{3}{3} \times 12\right) \\ 0 & 2 - \left(\frac{2}{3} \times 3\right) & -4 - \left(\frac{2}{3} \times 5\right) & 6 - \left(\frac{2}{3} \times 0\right) & -10 - \left(\frac{2}{3} \times 3\right) & 0 - \left(\frac{2}{3} \times -1\right) & 28 - \left(\frac{2}{3} \times 12\right) \\ 0 & -1 - \left(\frac{-1}{3} \times 3\right) & 9 - \left(\frac{-1}{3} \times 5\right) & -10 - \left(\frac{-1}{3} \times 0\right) & -15 - \left(\frac{-1}{3} \times 3\right) & 0 - \left(\frac{-1}{3} \times -1\right) & -43 - \left(\frac{-1}{3} \times 12\right) \end{array}$$

$$\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 & -11 \\ 0 & 0 & 4 & -6 & -8 & 7 & -35 \\ 0 & 0 & -2/3 & 6 & 20/3 & -2/3 & 36 \\ 0 & 0 & 22/3 & -10 & -40/3 & 7/3 & -47 \end{array}$$

$$\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 & -11 \\ 0 & 0 & 4 - \left(\frac{12}{7} \times \frac{7}{3}\right) & -6 - \left(\frac{12}{7} \times 2\right) & -8 - \left(\frac{12}{7} \times \frac{-13}{3}\right) & 7 - \left(\frac{12}{7} \times \frac{4}{3}\right) & -35 - \left(\frac{12}{7} \times -11\right) \\ 0 & 0 & -2/3 - \left(\frac{-6}{7} \times \frac{7}{3}\right) & 6 - \left(\frac{-6}{7} \times 2\right) & 20/3 - \left(\frac{-6}{7} \times \frac{-13}{3}\right) & -2/3 - \left(\frac{6}{7} \times \frac{4}{3}\right) & 36 - \left(\frac{-6}{7} \times -11\right) \\ 0 & 0 & 22/3 - \left(\frac{22}{7} \times \frac{7}{3}\right) & -10 - \left(\frac{22}{7} \times 2\right) & -40/3 - \left(\frac{22}{7} \times \frac{-13}{3}\right) & 7/3 - \left(\frac{22}{7} \times \frac{4}{3}\right) & -47 - \left(\frac{22}{7} \times -11\right) \end{array}$$

$$\begin{array}{cccccc|c} 1 & 1 & -3 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 7/3 & -2 & 13/3 & 4/3 & -11 \\ 0 & 0 & 0 & -18/7 & -4/7 & 33/7 & -113/7 \\ 0 & 0 & 0 & 38/7 & 38/7 & -2/7 & +230/7 \\ 0 & 0 & 0 & -26/7 & 2/7 & -13/7 & -87/7 \end{array}$$

$$\begin{array}{cccccc|c} 1 & -1 & -3 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 7/3 & -3 & -13/3 & 4/3 & -11 \\ 0 & 0 & 0 & -18/7 & -4/7 & 33/7 & -113/7 \\ 0 & 0 & 0 & 38/7 - \left(\frac{-38}{18} \times \frac{-18}{7}\right) & 38/7 - \left(\frac{-38}{18} \times \frac{-4}{7}\right) & -2/7 - \left(\frac{-38}{18} \times \frac{33}{7}\right) & -1230/7 - \left(\frac{-38}{18} \times \frac{-113}{7}\right) \\ 0 & 0 & 0 & -26/7 - \left(\frac{26}{18} \times \frac{-18}{7}\right) & 2/7 - \left(\frac{26}{18} \times \frac{-4}{7}\right) & -13/7 - \left(\frac{26}{18} \times \frac{33}{7}\right) & -87/7 - \left(\frac{26}{18} \times \frac{-113}{7}\right) \end{array}$$

$$\begin{array}{cccc|cc} 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 \\ 0 & 0 & 0 & 18/7 & -4/7 & 33/7 \\ 0 & 0 & 0 & 0 & 38/9 & 29/3 \\ 0 & 0 & 0 & 0 & 10/9 & -26/3 \\ 0 & 0 & 0 & 0 & 0 & 98/9 \end{array}$$

$$\begin{array}{cccc|cc} 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & 5 & -1 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 \\ 0 & 0 & 0 & -18/7 & -4/7 & 33/7 \\ 0 & 0 & 0 & 0 & 38/9 & 29/3 \\ 0 & 0 & 0 & 0 & 10/9 & -26/3 \\ 0 & 0 & 0 & 0 & 10/9 - (5/19 \times 38/9) & -36/3 - (5/19 \times 29/3) \\ & & & & & 98/9 - (5/19 \times 11/9) \end{array}$$

$$\begin{array}{cccc|cc} 1 & 1 & 2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & 5 & -1 & 12 \\ 0 & 0 & 4/3 & -2 & -13/3 & 4/3 & -11 \\ 0 & 0 & 0 & 18/7 & 4/7 & 33/7 & -113/7 \\ 0 & 0 & 0 & 0 & 38/9 & -29/3 & -11/9 \\ 0 & 0 & 0 & 0 & 0 & -213/19 & 213/19 \end{array}$$

$$\begin{array}{cccc|cc} 1 & 1 & 2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & 5 & -1 & 12 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 & -11 \\ 0 & 0 & 0 & 18/7 & 4/7 & 33/7 & -113/7 \\ 0 & 0 & 0 & 0 & 38/9 & -29/3 & -11/9 \\ 0 & 0 & 0 & 0 & 0 & -213/19 & 213/19 \end{array} = \begin{array}{cc} T_1 & 4 \\ T_2 & 12 \\ T_3 & -11 \\ T_4 & -113/7 \\ T_5 & -11/9 \\ T_6 & 213/19 \end{array}$$

$1 \times T_1 + 4 \times T_2$

$$\begin{array}{l} 1 \times T_1 + 4 \times T_2 + 2 \times T_3 + 1 \times T_4 + 3 \times T_5 + -7 \times T_6 \quad 4 \\ 0 \times T_1 + -3 \times T_2 + 5 \times T_3 + 0 \times T_4 + 5 \times T_5 + -1 \times T_6 \quad 12 \\ 0 \times T_1 + 0 \times T_2 + 7/3 \times T_3 + -2 \times T_4 + 13/3 \times T_5 + 4/3 \times T_6 \quad -11 \\ 0 \times T_1 + 0 \times T_2 + 0 \times T_3 + 18/7 \times T_4 + 4/7 \times T_5 + 33/7 \times T_6 \quad -113/7 \\ 0 \times T_1 + 0 \times T_2 + 0 \times T_3 + 0 \times T_4 + 38/9 \times T_5 + 29/3 \times T_6 \quad -11/9 \\ 0 \times T_1 + 0 \times T_2 + 0 \times T_3 + 0 \times T_4 + 0 \times T_5 + -213/19 \times T_6 \quad 213/19 \end{array}$$

$$-213T_6 = 213$$

$$T_6 = 213 \times -19$$

$$19 \quad 213 = -1$$

$$\frac{38T_5 + \frac{29}{3}(-1)}{9} = \frac{-11}{9}$$

$$T_5 = 1.0673 //$$

$$\frac{18T_4 + 4(1.0673) + (-33)}{7} = \frac{-113}{7}$$

$$T_4 = -18.213 //$$

$$T_3 = -24.058 //$$

$$T_2 = -29.542 //$$

$$T_1 = -0.5623 //$$

```
MATLAB
Editor - C:\Users\tomisin\Documents\MATLAB\ass3.m
INTERPOLATION.m x linear.m x Untitled.m x Ass1.m x ass3.m x ass2.m x +
1 - commandwindow
2 - clear
3 - clc
4 - format short g
5 - A=[1 1 -2 1 3 -1 ;2 -1 1 2 1 -3 ;1 3 -3 -1 2 1 ;5 2 -1 -1 2 1 ;-3 -1 2 3 1 3 ;4 3 1 -6 -3 -2];
6 - b=[4; 20; -15; -3; 16; -27];
7 - Aug= [A,b];
8 - [m,n]= size(Aug);
9 - for k = 1:n-1
10 -     for i = k+1 :n-1
11 -         if Aug(i,k)~= 0
12 -             q = Aug(i,k)/Aug(k,k);
13 -             Aug(i,k:n) = Aug(i,k:n) - q*Aug(k,k:n)
14 -         end
15 -     end
16 - end
17 - X = zeros(m,1)

Command Window
New to MATLAB? See resources for Getting Started.

Aug =
     1     1    -2     1     3    -1     4
     2    -1     1     2     1    -3    20
     1     3    -3    -1     2     1    -15
     5     2    -1    -1     2     1     3
    -3    -1     2     3     1     3    16
     4     3     1    -6    -3    -2    -27
```


MATLAB

Editor - C:\Users\tomisin\Documents\MATLAB\ass3.m

INTERPOLATION.m x linear.m x Untitled.m x Ass1.m x ass3.m x ass2.m x +

```

6 - b=[4; 20; -15; -3; 16; -27];
7 - Aug= [A,b];
8 - [m,n]= size(Aug);
9 - for k = 1:n-1
10 -     for i = k+1 :n-1
11 -         if Aug(i,k)~= 0
12 -             q = Aug(i,k)/Aug(k,k);
13 -             Aug(i,k:n) = Aug(i,k:n) - q*Aug(k,k:n)
14 -         end
15 -     end
16 - end
17 - X = zeros(m,1)
18 - X(m) = Aug(m,n)/Aug(m,m)
19 - for k = m-1:-1:1
20 -     X(k) = (Aug(k,n) - (Aug(k,k+1:m)*X(k+1:m)/Aug(k,k)))
21 - end
22 - x=X

```

Command Window

New to MATLAB? See resources for [Getting Started](#).

```

Aug =
     1     1    -2     1     3    -1     4
     0    -3     5     0    -5    -1    12
     1     3    -3    -1     2     1   -15
     5     2    -1    -1     2     1    -3

```

script Ln