Engineering Math Assignment III

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$$T_1 \quad T_2 \quad -2T_3 \quad T_4 \quad 3T_5 \quad -T_6 = 4$$
$$2T_1 \quad -T_2 \quad T_3 \quad 2T_4 \quad T_5 \quad -3T_6 = 20$$
$$T_1 \quad +3T_2 \quad -3T_3 \quad -T_4 \quad 2T_5 \quad T_6 = -15$$
$$5T_1 \quad 2T_2 \quad -T_3 \quad -T_4 \quad 2T_5 \quad T_6 = -3$$
$$-3T_1 \quad -T_2 \quad 2T_3 \quad 3T_4 \quad T_5 \quad 3T_6 = 16$$
$$4T_1 \quad 3T_2 \quad T_3 \quad -6T_4 \quad -3T_5 \quad -2T_6 = -27$$

~~[illegible]~~

Solution

$$\underbrace{\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 2 & -1 & 1 & 2 & 1 & -3 \\ 1 & 3 & -3 & -1 & 2 & 1 \\ 5 & 2 & -1 & -1 & 2 & 1 \\ -3 & -1 & 2 & 3 & 1 & 3 \\ 4 & 3 & 1 & -6 & -3 & -2 \end{bmatrix}}_{a} \underbrace{\begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix}}_{x} = \underbrace{\begin{bmatrix} 4 \\ 20 \\ -15 \\ -3 \\ 16 \\ -27 \end{bmatrix}}_{b}$$

$$f_{21} = \frac{a_{21}}{a_{11}} = 2/1 = 2$$

$$f_{31} = \frac{a_{31}}{a_{11}} = 1/1 = 1$$

$$f_{41} = \frac{a_{41}}{a_{11}} = 5/1 = 5$$

$$f_{51} = \frac{a_{51}}{a_{11}} = \frac{-3}{1} = -3$$

$$f_{61} = \frac{a_{61}}{a_{11}} = 4/1 = 4$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 2-2(1) & -1-2(1) & 1-2(-2) & 2-2(1) & 1-2(3) & -3-2(-1) \\ 1-1(1) & 3-(1) & -3-1(-2) & -1-1(1) & 2-1(3) & 1-1(-1) \\ 5-5(1) & 2-5(1) & -1-5(-2) & -1-5(1) & 2-5(3) & 1-5(-1) \\ -3+3(1) & -1+3(1) & 2+3(-2) & 3+3(1) & 1+3(3) & 3+3(-1) \\ 4-4(1) & 3-4(1) & 1-4(-2) & -6-4(1) & -3-4(3) & -2-4(-1) \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix}$$

$$= \begin{bmatrix} 4 \\ 20 - 2(4) \\ -15 - 1(4) \\ -8 - 5(4) \\ 19 + 3(4) \\ -21 - 9(4) \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 2 & -1 & -2 & -1 & 2 \\ 0 & -5 & 9 & -6 & -13 & 6 \\ 0 & 2 & -4 & 6 & 10 & 0 \\ 0 & -1 & 9 & 10 & -15 & 2 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -19 \\ -23 \\ 28 \\ -43 \end{bmatrix}$$

$$F_{32'} = \frac{a_{32'}}{a_{22'}} = \frac{2}{-3}$$

$$F_{42'} = \frac{a_{42'}}{a_{22'}} = -5/3 = 1$$

$$F_{52} = \frac{a_{52'}}{a_{22'}} = \frac{-2}{3}$$

$$I_{62} = \frac{a_{62'}}{a_{22'}} = \frac{-1}{-3} = \frac{1}{3}$$

$$\begin{bmatrix} 1 & 1 & 2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 2 + \frac{2}{3}(-3) & -1 + \frac{2}{3}(5) & -2 \frac{2}{3}(0) & -1 + \frac{2}{3}(-5) & 2 + \frac{2}{3}(-1) \\ 0 & -3 - 1(-3) & 9 + 1(5) & -6 - 1(0) & -13 + 1(-5) & 6 - 1(-1) \\ 0 & 2 + \frac{2}{3}(-3) & 4 + \frac{9}{3}(5) & 6 + \frac{9}{3}(0) & 10 + \frac{9}{3}(-5) & 0 + \frac{9}{3}(-1) \\ 0 & -1 - \frac{1}{3}(-3) & 9 - \frac{1}{3}(5) & -10 - \frac{1}{3}(0) & -15 - \frac{1}{3}(-5) & 2 - \frac{1}{3}(-1) \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix}$$

$$= \begin{bmatrix} 4 \\ 12 \\ -19 + \frac{2}{3}(12) \\ -23 - 1(12) \\ 28 + \frac{9}{3}(12) \\ -43 - 1(12) \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 \\ 0 & 0 & 4 & -6 & -8 & 7 \\ 0 & 0 & -2/3 & 6 & 20/3 & -2/3 \\ 0 & 0 & 22/3 & -10 & -90/3 & 7/3 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -11 \\ -85 \\ 36 \\ -47 \end{bmatrix}$$

$$T_{45} = \frac{a_{45}}{a_{55}} = \frac{4}{7/3} = \frac{12}{7}$$

$$T_{55} = \frac{a_{55}}{a_{55}} = \frac{-2}{3} \Big/ \frac{7}{3} = \frac{-2}{7}$$

$$T_{65} = \frac{a_{65}}{a_{55}} = \frac{22}{3} \Big/ \frac{7}{3} = \frac{22}{7}$$

$$\begin{bmatrix} 1 & 1 & 2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 2+\frac{2}{3}(-3) & -1+\frac{2}{3}(5) & -2+\frac{2}{3}(0) & -1+\frac{2}{3}(-5) & 2+\frac{2}{3}(-1) \\ 0 & -3-1(-3) & 9+1(5) & -6+(0) & -13+(-5) & 6-1(-1) \\ 0 & 2+\frac{2}{3}(-3) & 4+\frac{2}{3}(5) & 6+\frac{2}{3}(0) & 10+\frac{2}{3}(-5) & 0+\frac{2}{3}(-1) \\ 0 & -1-\frac{1}{3}(-3) & 9-\frac{1}{3}(5) & -10-\frac{1}{3}(0) & -15-\frac{1}{3}(-5) & 2-\frac{1}{3}(-1) \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix}$$

$$= \begin{bmatrix} 4 \\ 12 \\ -19+\frac{2}{3}(12) \\ -23-1(12) \\ 28+\frac{2}{3}(12) \\ -48-\frac{1}{3}(12) \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 \\ 0 & 0 & 4 & -6 & -8 & 7 \\ 0 & 0 & -2/3 & 6 & 20/3 & -2/3 \\ 0 & 0 & 22/3 & -10 & -90/3 & 7/3 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -4 \\ -55 \\ 36 \\ -47 \end{bmatrix}$$

MathLab Code

```
commandwindow
clear
close all
clc
format short g
syms t t1 t2 t3 t4 t5 t6
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]
B= [ 4; 20; -15; -3; 16; -27]


F21= A(2,1)/A(1,1);
F31= A(3,1)/A(1,1);
F41= A(4,1)/A(1,1);
F51= A(5,1)/A(1,1);
F61= A(6,1)/A(1,1);
A = [1 1 -2 1 3 -1
    A(2,1)-(F21*A(1,1)) A(2,2)-(F21*A(1,2)) A(2,3)-(F21*A(1,3)) A(2,4)-
(F21*A(1,4)) A(2,5)-(F21*A(1,5)) A(2,6)-(F21*A(1,6))
    A(3,1)-(F31*A(1,1)) A(3,2)-(F31*A(1,2)) A(3,3)-(F31*A(1,3)) A(3,4)-
(F31*A(1,4)) A(3,5)-(F31*A(1,5)) A(3,6)-(F31*A(1,6))
    A(4,1)-(F41*A(1,1)) A(4,2)-(F41*A(1,2)) A(4,3)-(F41*A(1,3)) A(4,4)-
(F41*A(1,4)) A(4,5)-(F41*A(1,5)) A(4,6)-(F41*A(1,6))
    A(5,1)-(F51*A(1,1)) A(5,2)-(F51*A(1,2)) A(5,3)-(F51*A(1,3)) A(5,4)-
(F51*A(1,4)) A(5,5)-(F51*A(1,5)) A(5,6)-(F51*A(1,6))
    A(6,1)-(F61*A(1,1)) A(6,2)-(F61*A(1,2)) A(6,3)-(F61*A(1,3)) A(6,4)-
(F61*A(1,4)) A(6,5)-(F61*A(1,5)) A(6,6)-(F61*A(1,6))]
B= [B(1,1); B(2,1)-F21*B(1,1); B(3,1)-F31*B(1,1); B(4,1)-F41*B(1,1); B(5,1)-
F51*B(1,1); B(6,1)-F61*B(1,1)]



F32= A(3,2)/A(2,2);
F42 = A(4,2)/A(2,2);
F52 = A(5,2)/A(2,2);
F62 = A(6,2)/A(2,2);
A= [A(1,1) A(1,2) A(1,3) A(1,4) A(1,5) A(1,6)
    A(2,1) A(2,2) A(2,3) A(2,4) A(2,5) A(2,6)
    A(3,1) A(3,2)-(F32*A(2,2)) A(3,3)-(F32*A(2,3)) A(3,4)-(F32*A(2,4))
A(3,5)-(F32*A(2,5)) A(3,6)-(F32*A(2,6))
    A(4,1) A(4,2)-(F42*A(2,2)) A(4,3)-(F42*A(2,3)) A(4,4)-(F42*A(2,4))
A(4,5)-(F42*A(2,5)) A(4,6)-(F42*A(2,6))
    A(5,1) A(5,2)-(F52*A(2,2)) A(5,3)-(F52*A(2,3)) A(5,4)-(F52*A(2,4))
A(5,5)-(F52*A(2,5)) A(5,6)-(F52*A(2,6))
    A(6,1) A(6,2)-(F62*A(2,2)) A(6,3)-(F62*A(2,3)) A(6,4)-(F62*A(2,4))
A(6,5)-(F62*A(2,5)) A(6,6)-(F62*A(2,6))]
B= [B(1,1); B(2,1); B(3,1)-F32*B(2,1); B(4,1)-F42*B(2,1); B(5,1)-F52*B(2,1);
B(6,1)-F62*B(2,1)]
```

```
F43= A(4,3)/A(3,3);
F53 = A(5,3)/A(3,3);
F63 = A(6,3)/A(3,3);
A =[ A(1,1) A(1,2) A(1,3) A(1,4) A(1,5) A(1,6)
     A(2,1) A(2,2) A(2,3) A(2,4) A(2,5) A(2,6)
     A(3,1) A(3,2) A(3,3) A(3,4) A(3,5) A(3,6)
     A(4,1) A(4,2) A(4,3)-(F43*A(3,3)) A(4,4)-(F43*A(3,4)) A(4,5)-
(F43*A(3,5)) A(4,6)-(F43*A(3,6))
     A(5,1) A(5,2) A(5,3)-(F53*A(3,3)) A(5,4)-(F53*A(3,4)) A(5,5)-
(F53*A(3,5)) A(5,6)-(F53*A(3,6))
     A(6,1) A(6,2) A(6,3)-(F63*A(3,3)) A(6,4)-(F63*A(3,4)) A(6,5)-
(F63*A(3,5)) A(6,6)-(F63*A(3,6))]
 B = [B(1,1); B(2,1); B(3,1); B(4,1)-F43*B(3,1); B(5,1)-F53*B(3,1); B(6,1)-
F63*B(3,1)]

 F54 = A(5,4)/A(4,4);
F64 = A(6,4)/A(4,4);
A = [ A(1,1) A(1,2) A(1,3) A(1,4) A(1,5) A(1,6)
     A(2,1) A(2,2) A(2,3) A(2,4) A(2,5) A(2,6)
     A(3,1) A(3,2) A(3,3) A(3,4) A(3,5) A(3,6)
     A(4,1) A(4,2) A(4,3) A(4,4) A(4,5) A(4,6)
     A(5,1) A(5,2) A(5,3) A(5,4)-(F54*A(4,4)) A(5,5)-(F54*A(4,5)) A(5,6)-
(F54*A(4,6))
     A(6,1) A(6,2) A(6,3) A(6,4)-(F64*A(4,4)) A(6,5)-(F64*A(4,5)) A(6,6)-
(F64*A(4,6))]
 B = [B(1,1); B(2,1); B(3,1); B(4,1); B(5,1)-F54*B(4,1); B(6,1)-F64*B(4,1)]

 F65= A(6,5)/A(5,5)
A= [ A(1,1) A(1,2) A(1,3) A(1,4) A(1,5) A(1,6)
     A(2,1) A(2,2) A(2,3) A(2,4) A(2,5) A(2,6)
     A(3,1) A(3,2) A(3,3) A(3,4) A(3,5) A(3,6)
     A(4,1) A(4,2) A(4,3) A(4,4) A(4,5) A(4,6)
     A(5,1) A(5,2) A(5,3) A(5,4) A(5,5) A(5,6)
     A(6,1) A(6,2) A(6,3) A(6,4) A(6,5)-(F65*A(5,5)) A(6,6)-(F65*A(5,6))]
 B= [B(1,1); B(2,1); B(3,1); B(4,1); B(5,1); B(6,1)-(F65*B(5,1))]
 T6 = B(6,1)/A(6,6)
 T5 = (B(5,1)-(A(5,6)*T6))/A(5,5)
 T4 = (B(4,1)-(A(4,5)*T5)-(A(4,6)*T6))/A(4,4)
 T3 = (B(3,1)-(A(3,4)*T4)-(A(3,5)*T5)-(A(3,6)*T6))/A(3,3)
 T2 = (B(2,1)-(A(2,3)*T3)-(A(2,4)*T4)-(A(2,5)*T5)-(A(2,6)*T6))/A(2,2)
 T1 = (B(1,1)-(A(1,2)*T2)-(A(1,3)*T3)-(A(1,4)*T4)-(A(1,5)*T5)-
(A(1,6)*T6))/A(1,1)
```

Output

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
```

B =

```
    4
   20
  -15
   -3
   16
  -27
```

A =

```
    1    1   -2    1    3   -1
    0   -3    5    0   -5   -1
    0    2   -1   -2   -1    2
    0   -3    9   -6  -13    6
    0    2   -4    6   10    0
```

0 -1 9 -10 -15 2

B =

4

12

-19

-23

28

-43

A =

1	1	-2	1	3	-1
0	-3	5	0	-5	-1
0	0	2.3333	-2	-4.3333	1.3333
0	0	4	-6	-8	7
0	0	-0.66667	6	6.6667	-0.66667
0	0	7.3333	-10	-13.333	2.3333

B =

4

12

-11

-35

36

-47

A =

1	1	-2	1	3	-1
0	-3	5	0	-5	-1
0	0	2.3333	-2	-4.3333	1.3333
0	0	0	-2.5714	-0.57143	4.7143
0	0	0	5.4286	5.4286	-0.28571
0	0	0	-3.7143	0.28571	-1.8571

B =

4

12

-11

-16.143

32.857

-12.429

A =

1	1	-2	1	3	-1
0	-3	5	0	-5	-1
0	0	2.3333	-2	-4.3333	1.3333
0	0	0	-2.5714	-0.57143	4.7143
0	0	0	0	4.2222	9.6667
0	0	0	0	1.1111	-8.6667

B =

4

12

-11

-16.143

-1.2222

10.889

F65 =

0.26316

A =

1	1	-2	1	3	-1
0	-3	5	0	-5	-1
0	0	2.3333	-2	-4.3333	1.3333
0	0	0	-2.5714	-0.57143	4.7143
0	0	0	0	4.2222	9.6667
0	0	0	0	0	-11.211

B =

4
12
-11
-16.143
-1.2222
11.211

T6 =

-1

T5 =

2

T4 =

4

T3 =

3

T2 =

-2

T1 =

1

>>