TESTING OF TOOL

8.1 SOLVING SIMPLY SUPPORTED BEAM

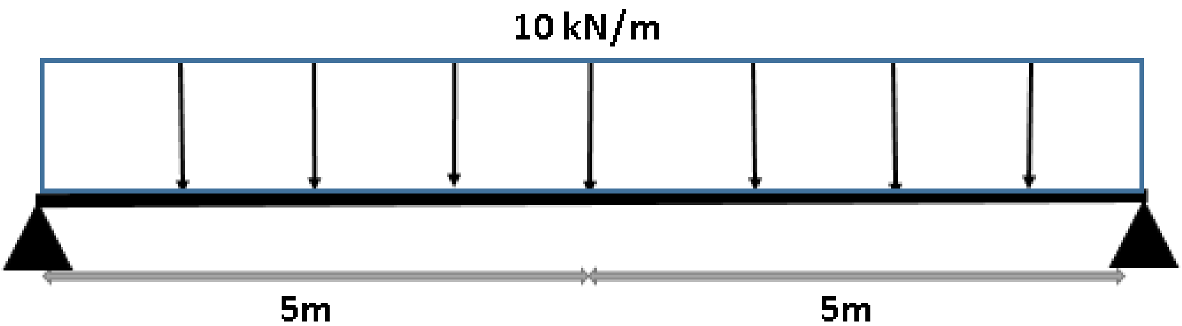


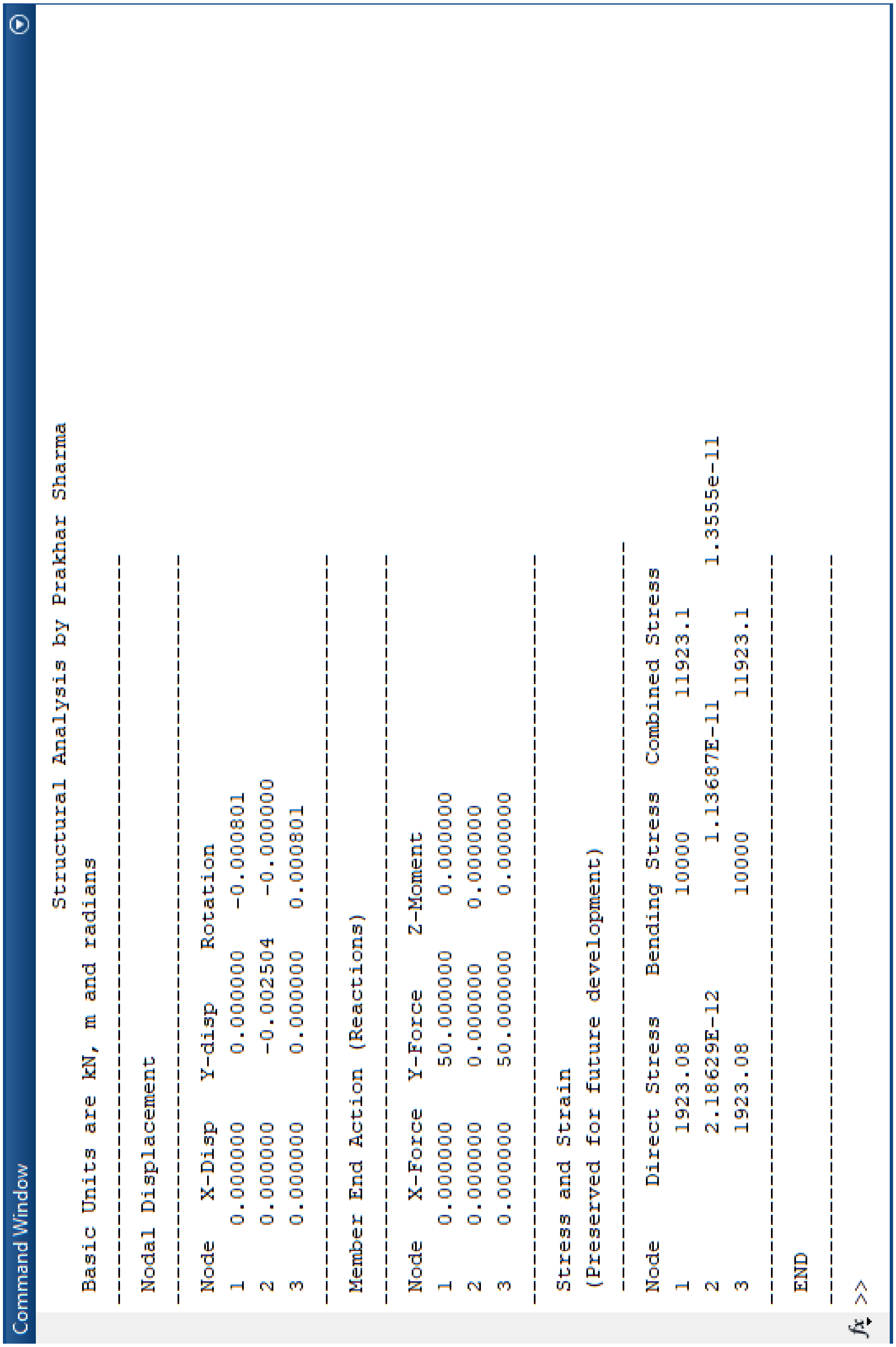
Fig 8.1 Simply supported beam

Length of the beam = 10m, and a square cross section of 0.25m*0.5m. Young's modulus is 200GPa.

$I = 2.6 \times 10^{-3}\ m^4$ and $A = 0.125\ m^2$

```
%% Data Input Section
E_M=[2*10^8;2*10^8];
I_M=[2.6*10^(-3); 2.6*10^(-3)];
A_M=[0.125;0.125];
node=[0 0;5 0;10 0];
conn=[1 2;2 3];
fdof=[3 5 6 9];
f(2)=-25;f(5)=-50;f(8)=-25; % Y-forces
f(3)=-20.83;f(6)=-20.83+20.83;f(9)=20.83; % Z-moments
```

Above input snippet is based on the 3 DOF per node analogy. The output of the program is given in Fig 8.2. The Distorted geometry, BMD and the SFD are given is subsequent figures. Since, this question involves UDL, hence the shape of SFD and BMD is not correct, but the nodal values of SFD and BMD are exact.



```
Command Window

                    Structural Analysis by Prakhar Sharma
Basic Units are kN, m and radians
-------------------------------------------
Nodal Displacement
-------------------------------------------
Node   X-Disp     Y-disp      Rotation
1      0.000000   0.000000    -0.000801
2      0.000000   -0.002504   -0.000000
3      0.000000   0.000000    0.000801
-------------------------------------------
Member End Action (Reactions)
-------------------------------------------
Node   X-Force    Y-Force     Z-Moment
1      0.000000   50.000000   0.000000
2      0.000000   0.000000    0.000000
3      0.000000   50.000000   0.000000
-------------------------------------------
Stress and Strain
(Preserved for future development)
-------------------------------------------
Node   Direct Stress   Bending Stress   Combined Stress
1      1923.08         10000            11923.1
2      2.18629E-12     1.13687E-11      1.3555e-11
3      1923.08         10000            11923.1
-------------------------------------------
END
-------------------------------------------
>>
```

Fig 8.2 Output screen for example-1

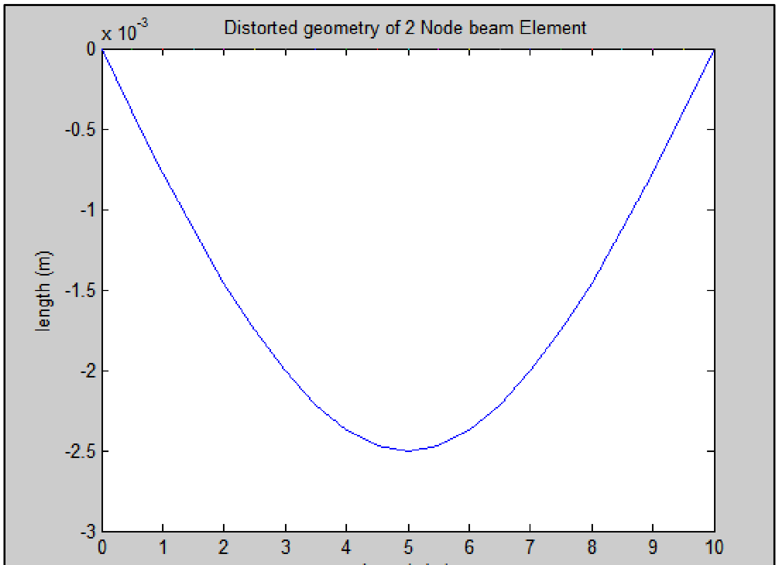


Fig 8.3 Distorted geometry of example-1

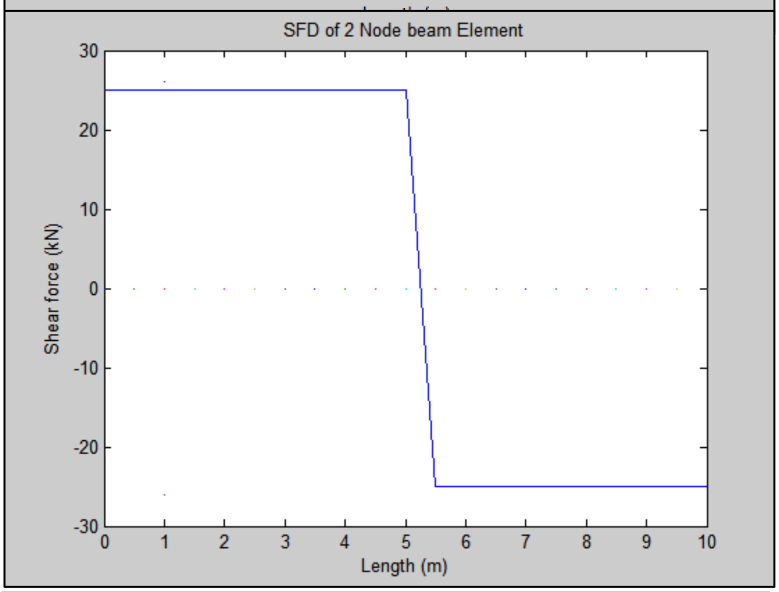


Fig 8.4 SFD of example-1

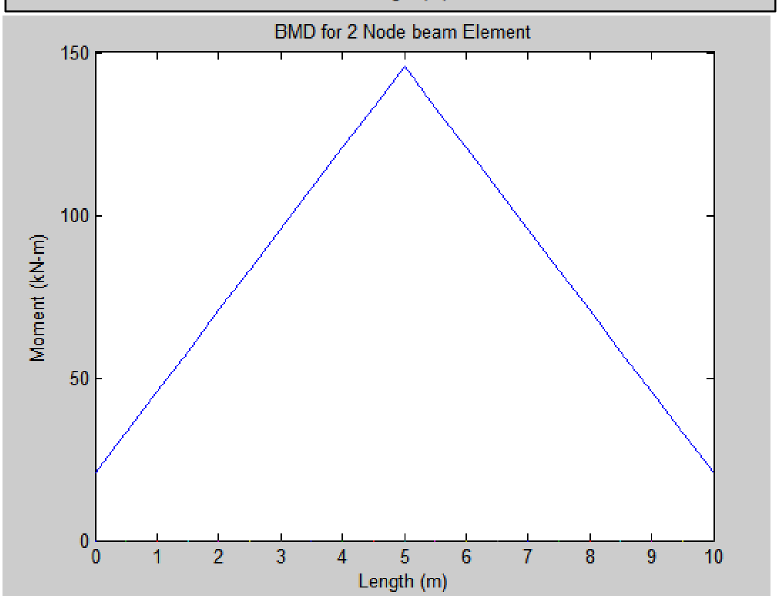


Fig 8.5 BMD of example-1

8.2 SOLVING FIXED BEAM

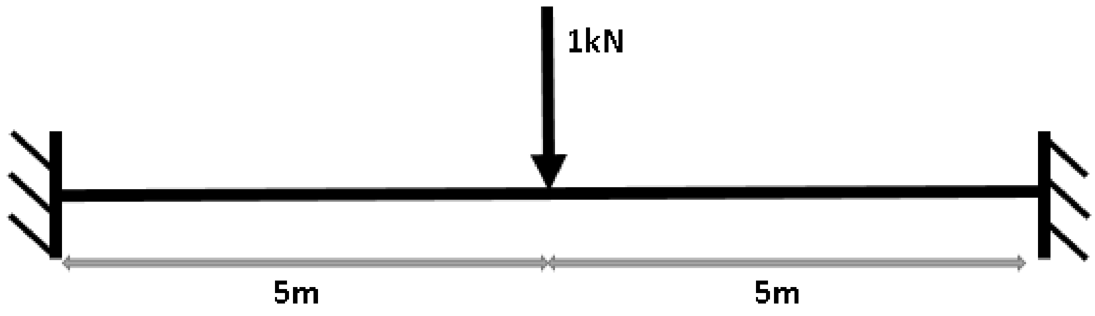


Fig 8.6 Fixed Beam

$E = 2 \times 10^{8}$ kN/m^{2}

$I = 4 \times 10^{-6}$ m^{4}

```
%% Data Input Section
E_M=[2*10^8;2*10^8];
I_M=[4*10^(-6); 4*10^(-6)];
A_M=[0;0];    % Not applicable for beams
node=[0 0;5 0;10 0];
conn=[1 2;2 3];
fdof=[4 5 6];
f(5)=-1;
```

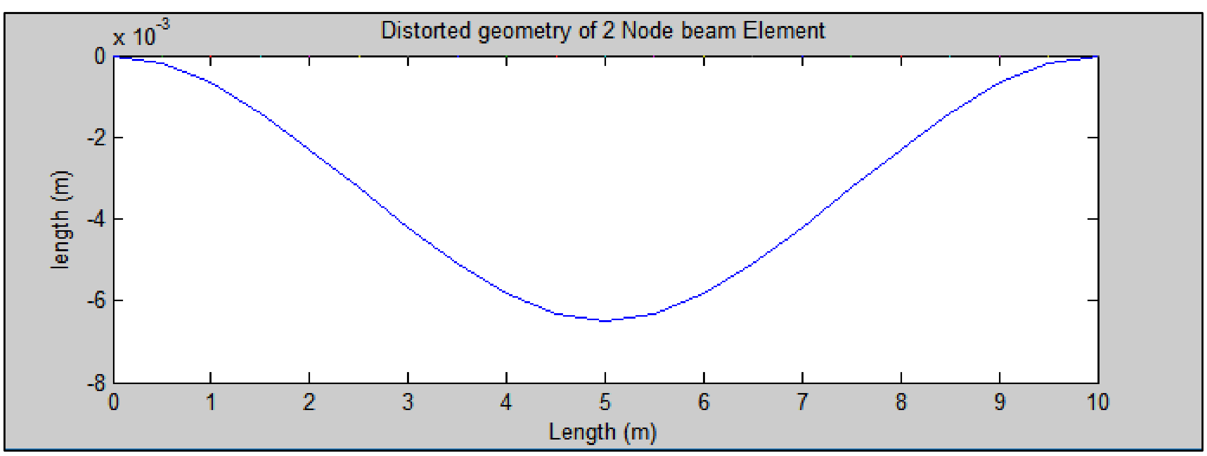
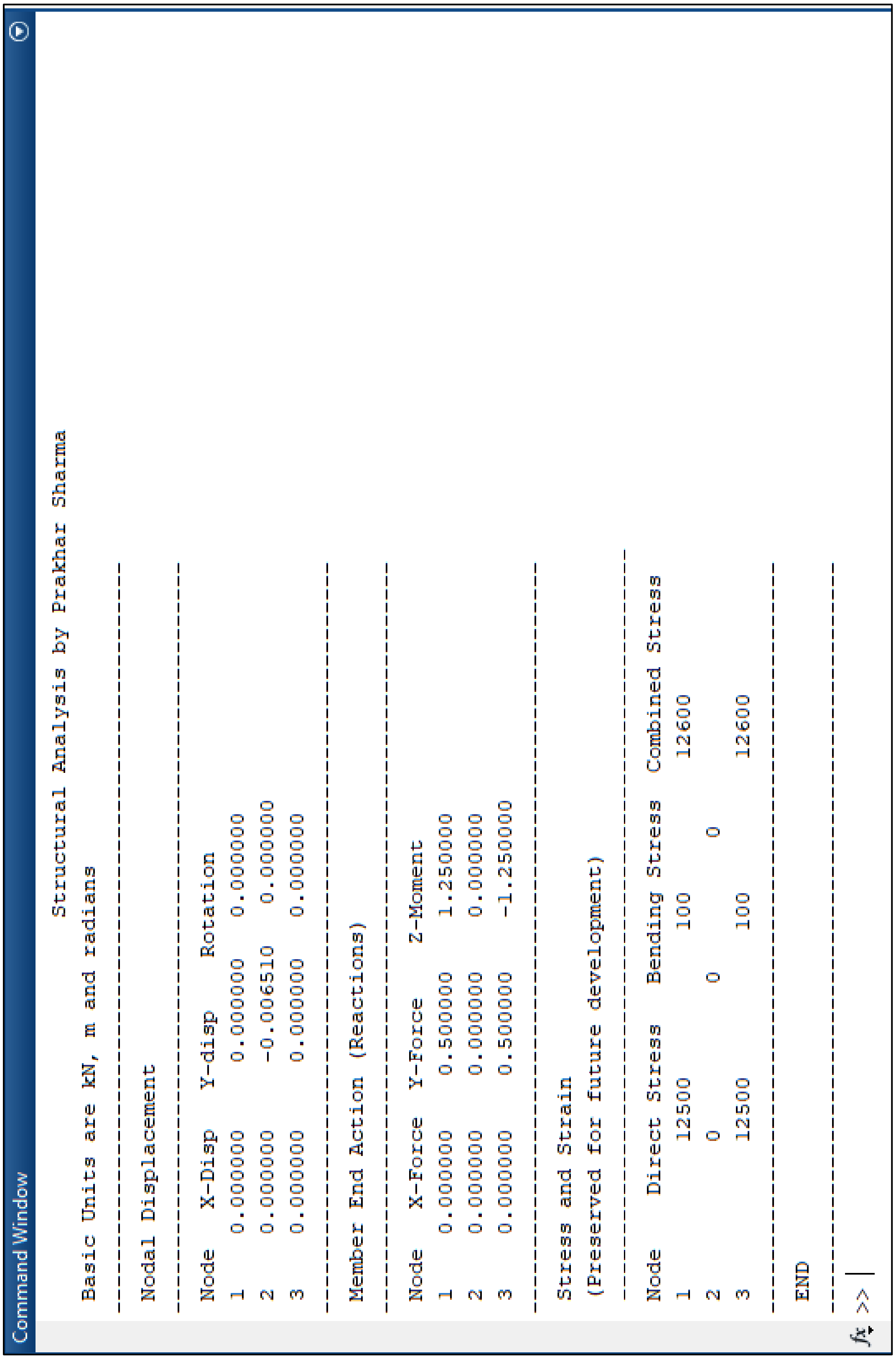


Fig 8.7 Distorted geometry of example-2



```
Command Window
                    Structural Analysis by Prakhar Sharma
Basic Units are kN, m and radians
--------------------------------------------------
Nodal Displacement
--------------------------------------------------
Node   X-Disp     Y-disp      Rotation
1      0.000000   0.000000    0.000000
2      0.000000   -0.006510   0.000000
3      0.000000   0.000000    0.000000
--------------------------------------------------
Member End Action (Reactions)
--------------------------------------------------
Node   X-Force    Y-Force     Z-Moment
1      0.000000   0.500000    1.250000
2      0.000000   0.000000    0.000000
3      0.000000   0.500000    -1.250000
--------------------------------------------------
Stress and Strain
(Preserved for future development)
--------------------------------------------------
Node   Direct Stress   Bending Stress   Combined Stress
1      12500           100              12600
2      0               0                0
3      12500           100              12600
--------------------------------------------------
END
--------------------------------------------------
>>
```

Fig 8.8 Output screen for example-2

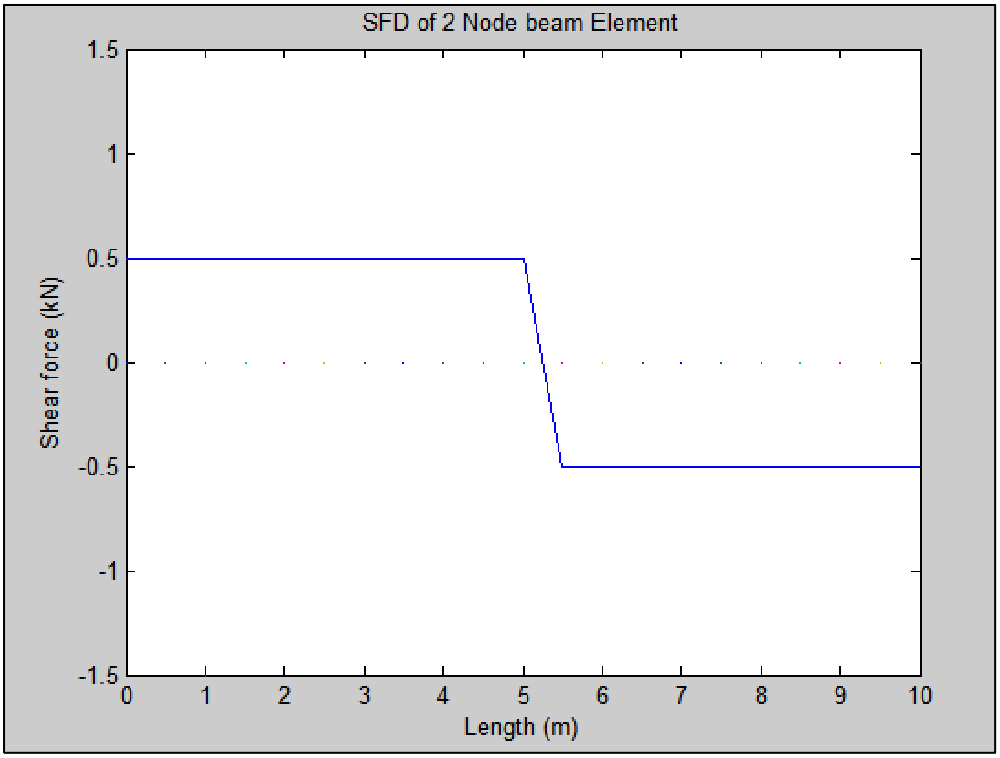


Fig 8.9 SFD for example-2

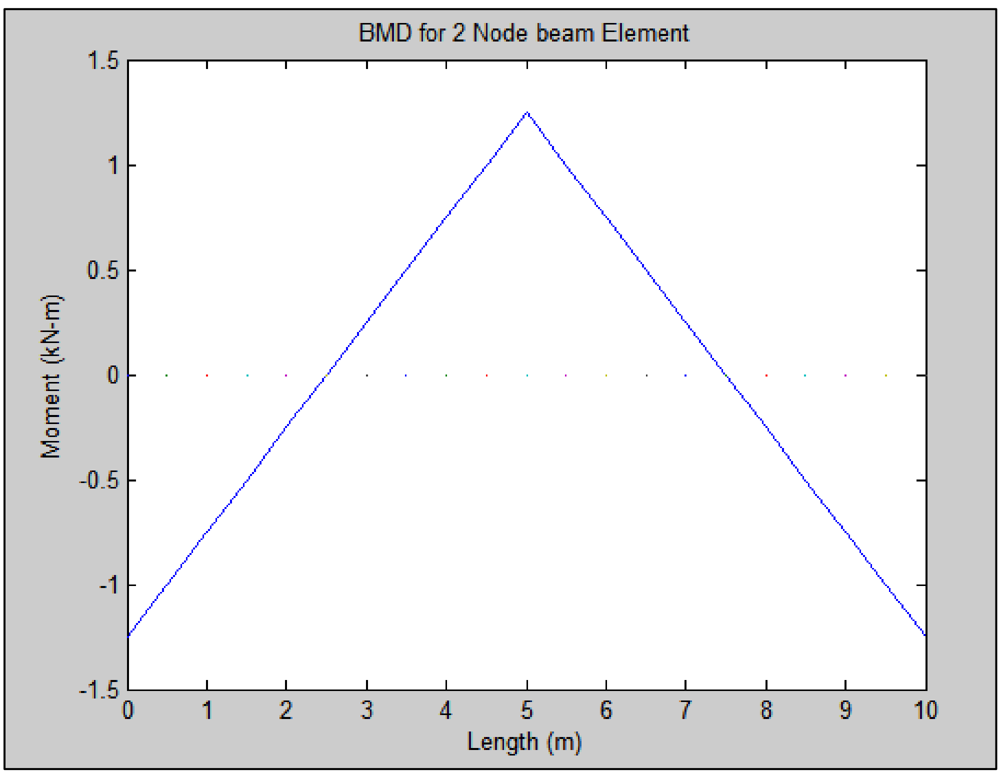


Fig 8.10 BMD for example-2

8.3 SOLVING CANTILEVER BEAM

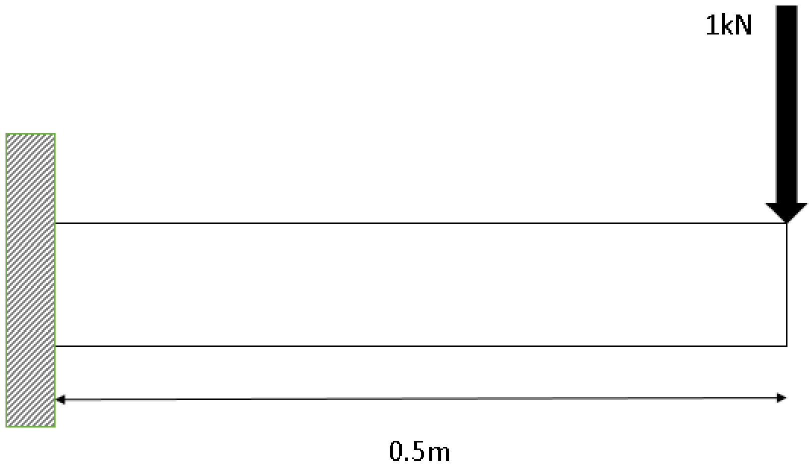


Fig 8.11 Cantilever Beam

E= 2 x 10^8 kN/m^2

I= 4 x 10^{-6} m^4

```
%% Data Input Section
E_M=[2*10^8];
I_M=[4*10^(-6)];
A_M=[0;0];   % Not applicable for beams
node=[0 0;0.5 0];
conn=[1 2];
fdof=[4 5 6];
f(5)=-1;
```

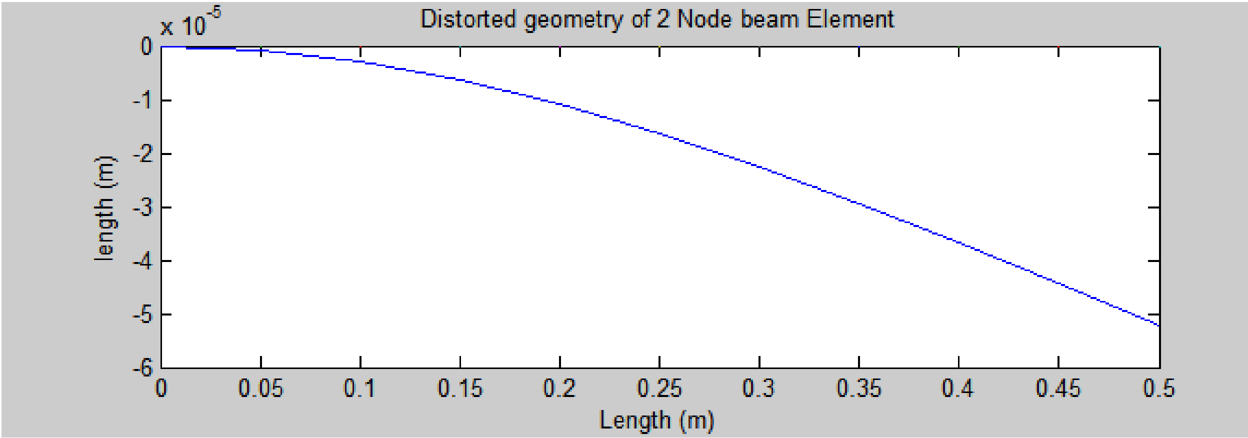
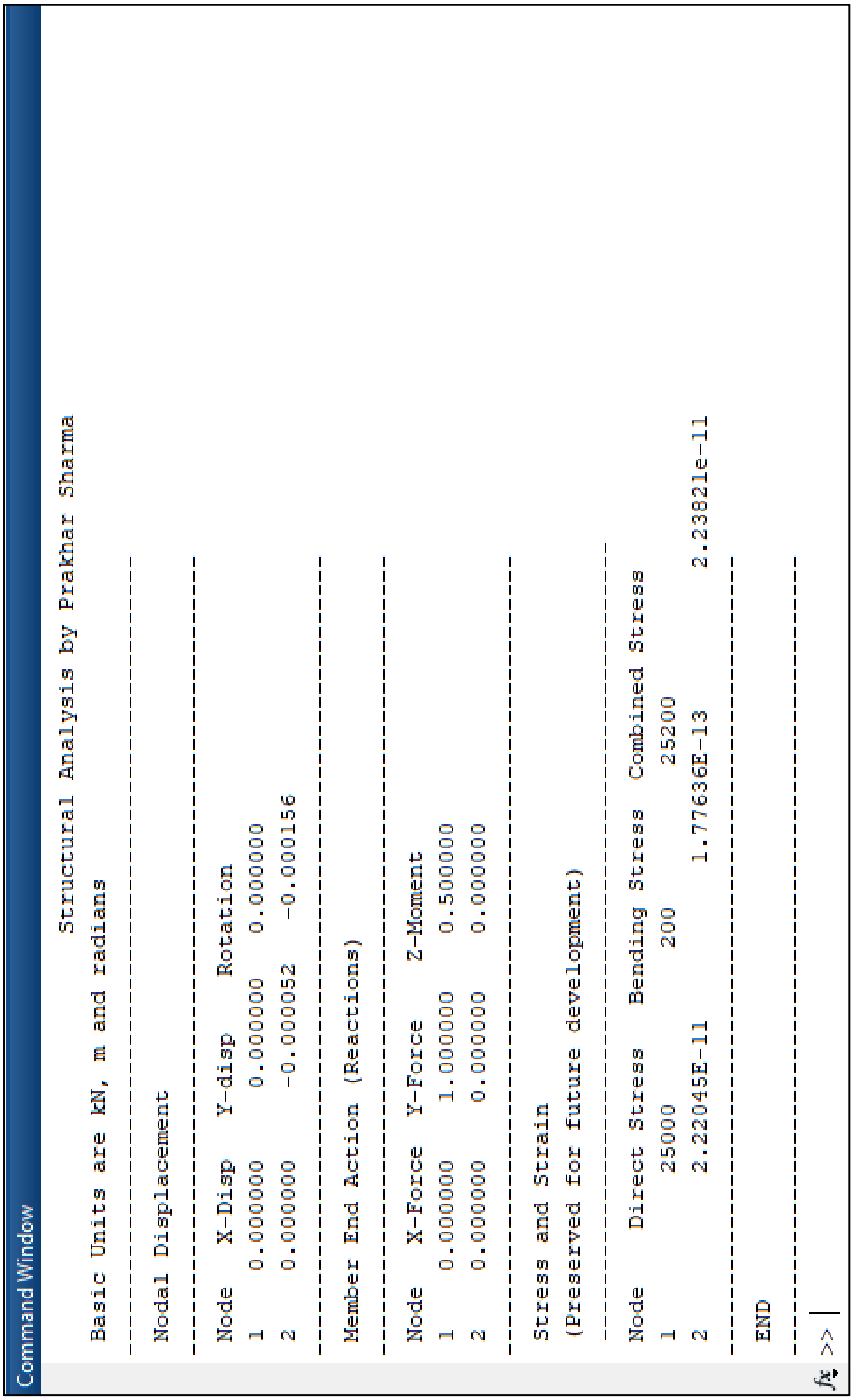


Fig 8.12 Distorted geometry of example-3



```
Command Window
                    Structural Analysis by Prakhar Sharma
Basic Units are kN, m and radians
-------------------------------------------------------------------
Nodal Displacement
-------------------------------------------------------------------
Node   X-Disp    Y-disp    Rotation
1   0.000000   0.000000   0.000000
2   0.000000   -0.000052   -0.000156
-------------------------------------------------------------------
Member End Action (Reactions)
-------------------------------------------------------------------
Node   X-Force   Y-Force   Z-Moment
1   0.000000   1.000000   0.500000
2   0.000000   0.000000   0.000000
-------------------------------------------------------------------
Stress and Strain
(Preserved for future development)
--------------------------------------------------------------------
Node   Direct Stress   Bending Stress   Combined Stress
1      25000      200      25200
2      2.22045E-11      1.77636E-13      2.23821e-11
-------------------------------------------------------------------
END
-------------------------------------------------------------------
fx >>
```

Fig 8.13 Output for example-3

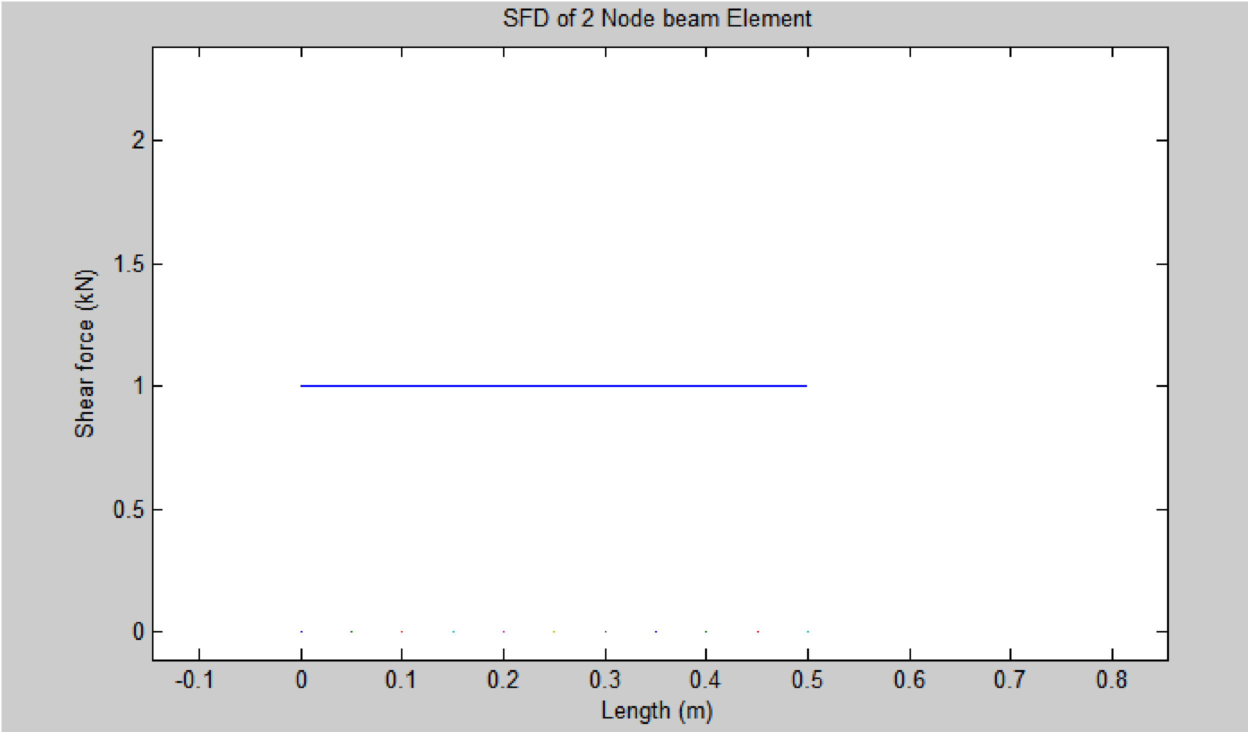


Fig 8.14 SFD for example-3

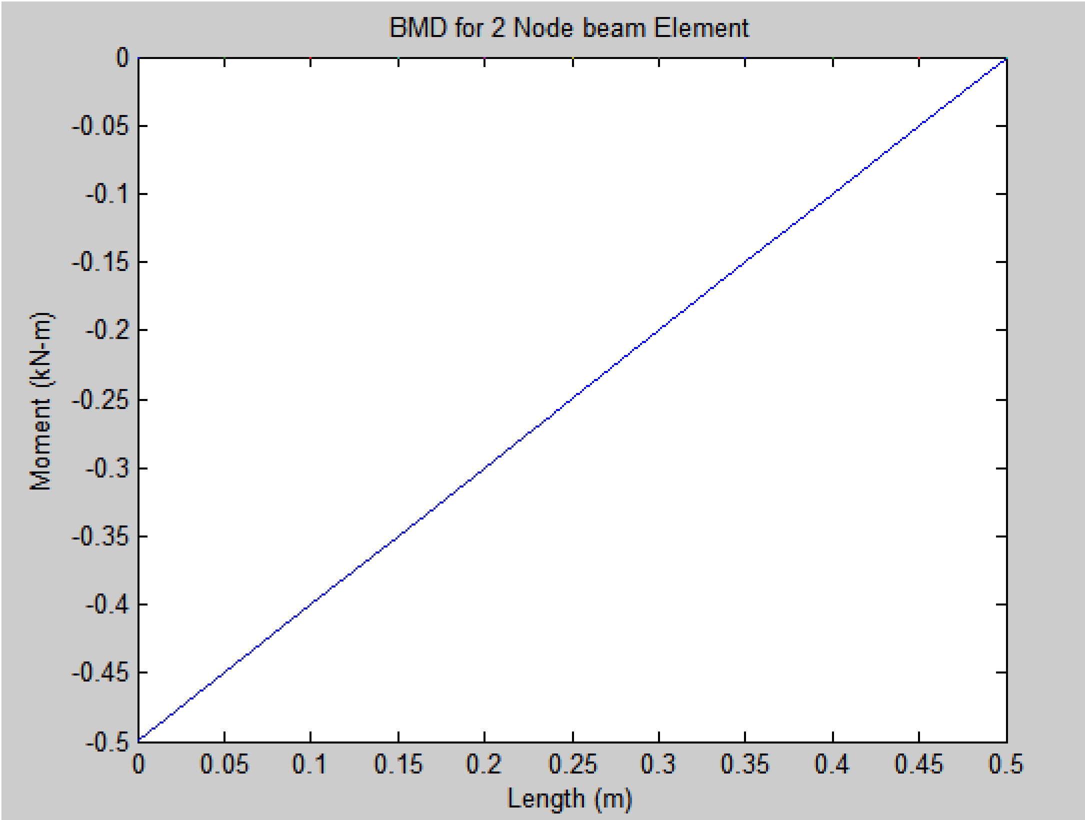


Fig 8.15 BMD for example-3

8.4 SOLVING 2D PORTAL FRAME

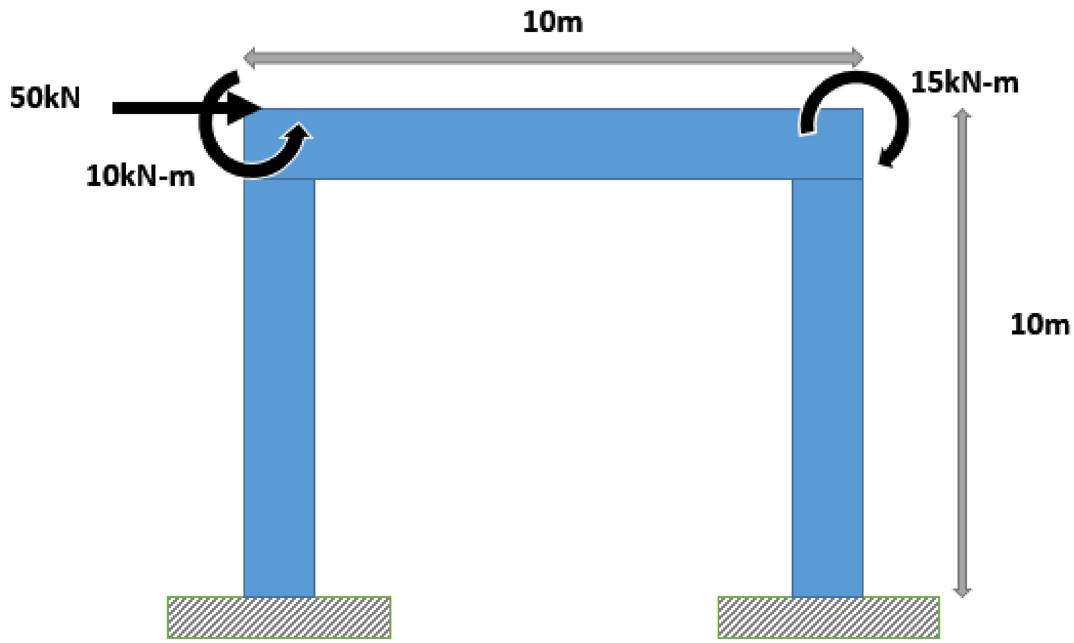


Fig 8.16 2D Frame

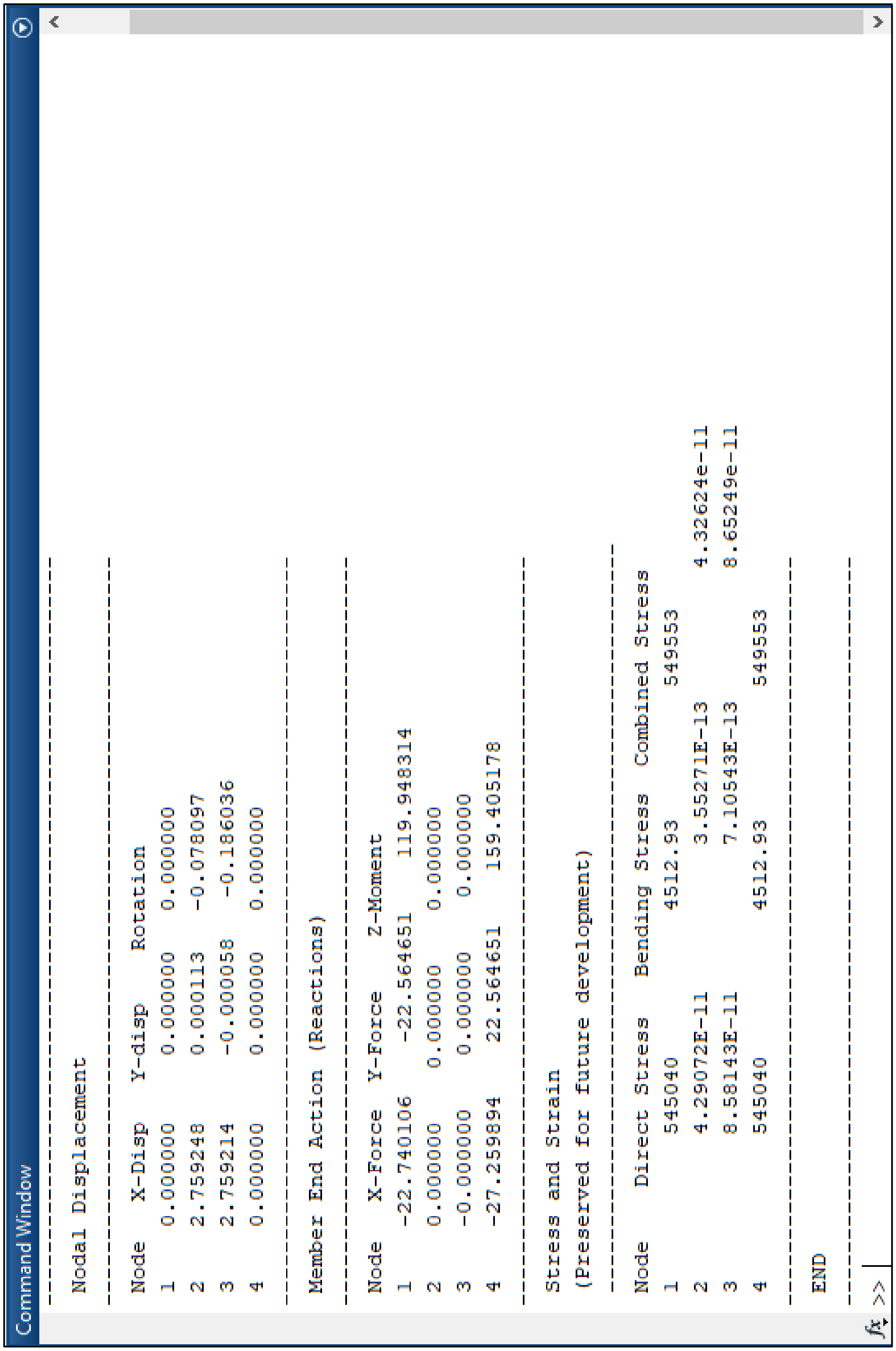
E= 2 x 10^8 kN/m^2, 4 x 10^8 kN/m^2, 3 x 10^8 kN/m^2

I= 4 x 10^{-6} m^4, 3.56 x 10^{-6} m^4, 4.14 x 10^{-6} m^4

A=0.01 m^2, 0.02 m^2, 0.0129 m^2

```
%% Data Input Section
E_M=[2*10^8,4*10^8,3*10^8];
I_M=[4*10^(-6),3.56*10^(-6),4.14*10^(-6)];
A_M=[0.01;0.02,0.0129];
node=[0 0;0 10,10 10,10 0];
conn=[1 2,2 3,3 4];
fdof=[4 5 6 7 8 9];
f(4)=50;
f(6)=10;
f(9)=-15;
```

Since, I have used trial function of insufficient order and hence the visual output will never be correct. Nevertheless, our textual output will be always true.



```
Command Window
------------------------------------------------
Nodal Displacement
------------------------------------------------
Node   X-Disp     Y-disp     Rotation
1      0.000000   0.000000   0.000000
2      2.759248   0.000113   -0.078097
3      2.759214   -0.000058  -0.186036
4      0.000000   0.000000   0.000000
------------------------------------------------
Member End Action (Reactions)
------------------------------------------------
Node   X-Force      Y-Force      Z-Moment
1      -22.740106   -22.564651   119.948314
2      0.000000     0.000000     0.000000
3      -0.000000    0.000000     0.000000
4      -27.259894   22.564651    159.405178
------------------------------------------------
Stress and Strain
(Preserved for future development)
------------------------------------------------
Node   Direct Stress   Bending Stress   Combined Stress
1        545040          4512.93          549553
2      4.29072E-11     3.55271E-13      4.32624e-11
3      8.58143E-11     7.10543E-13      8.65249e-11
4        545040          4512.93          549553
------------------------------------------------
END
------------------------------------------------
```

Fig 8.17 Output for example-4