Deflection Of Beams
(MATLAB APPLICATION)

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Questions:

Find the Bending Moment And Shear Force Diagram For the Following Cases:

Assume $E = 1 \times 10^6\,Nm^2$

a) Simply Supported Beam of Length 5m:

P = 4 kN(Upwards) at 1m from one of the ends

b) Simply Supported Beam of Length 10m:

P = 6 kN(Downwards) at 3m from one end and M = 7 kNm(Anti-Clockwise) at 3m from the other end. Also a distributed load of 4 $\frac{kN}{m}$(Downwards) is applied at a distance of 1m from P for a length of 2m.

c) Canteliver Beam of Length 10m:

P = 6 kN(Downwards) at 3m from free end.

d) Canteliver Beam of Length 5m:

P = 12 kN(Downwards) at the free end and M = 7 kNm(Clockwise) at 2m from the free end. Also a distributed load of 4 $\frac{kN}{m}$(Downwards) is applied at a distance of 3m from the free for a length of 1m.

Solution:

While solving the Problems, we have assumed the following conventions,

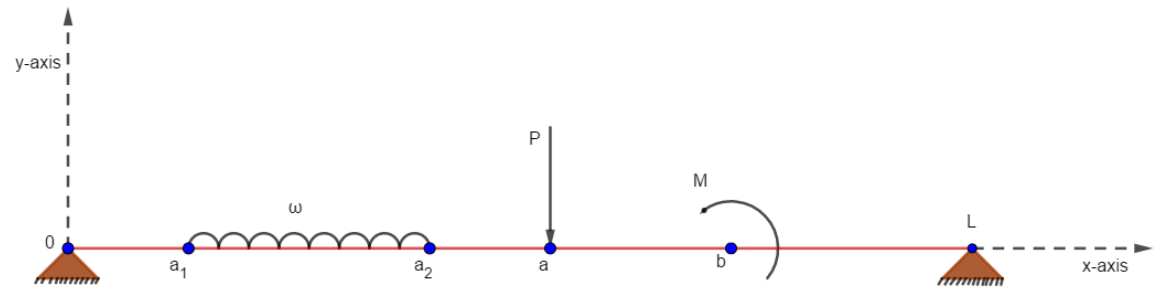


Figure 1. Simply Supported Beam

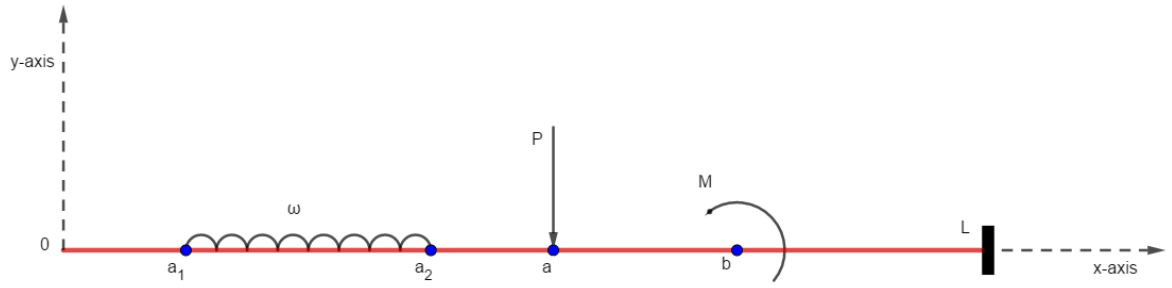


Figure 2. Cantilever Beam

UI Figure

Input Panel

Bending Moment AND Shear Force Diagram

Type of Beam: Simply Supported

Material Properties

Flextural Rigidity (in N. m²): 1e+06

Length (L in 'm'): 5

Concentrated Load (P)

P (in KN): 4 a (in 'm'): 1

Moment (Mo)

Mo (in KNm): 0

b (in 'm'): 0

Uniformly Distributed Load (w)

w (in 'KN/m'): 0

a1 (in 'm'): 0 a2 (in 'm'): 0

Analyse | Reset

Values at Maximum Deflection

Max_x (Distance in 'm'): 2.1700

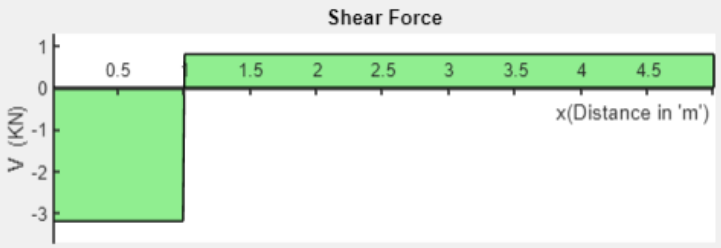
Delection (in 'mm') : 6.0340e+00

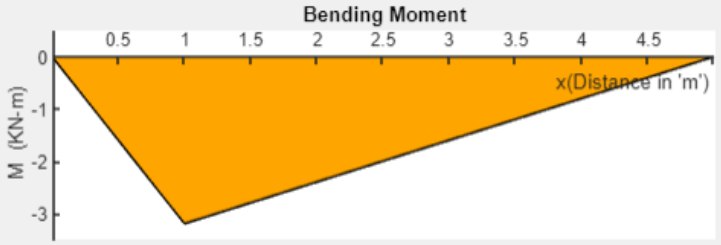
Shear Force (in 'KN') : 8.0000e-01

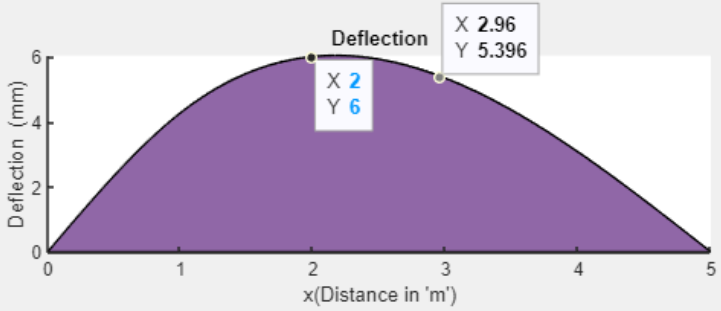
Bending Moment (KN-m): -2.2640e+00

Output Panel

Graphs







Search Panel

x_Value (Distance in 'm'): 2

Search

Deflection (in 'mm') : 6.0000e+00

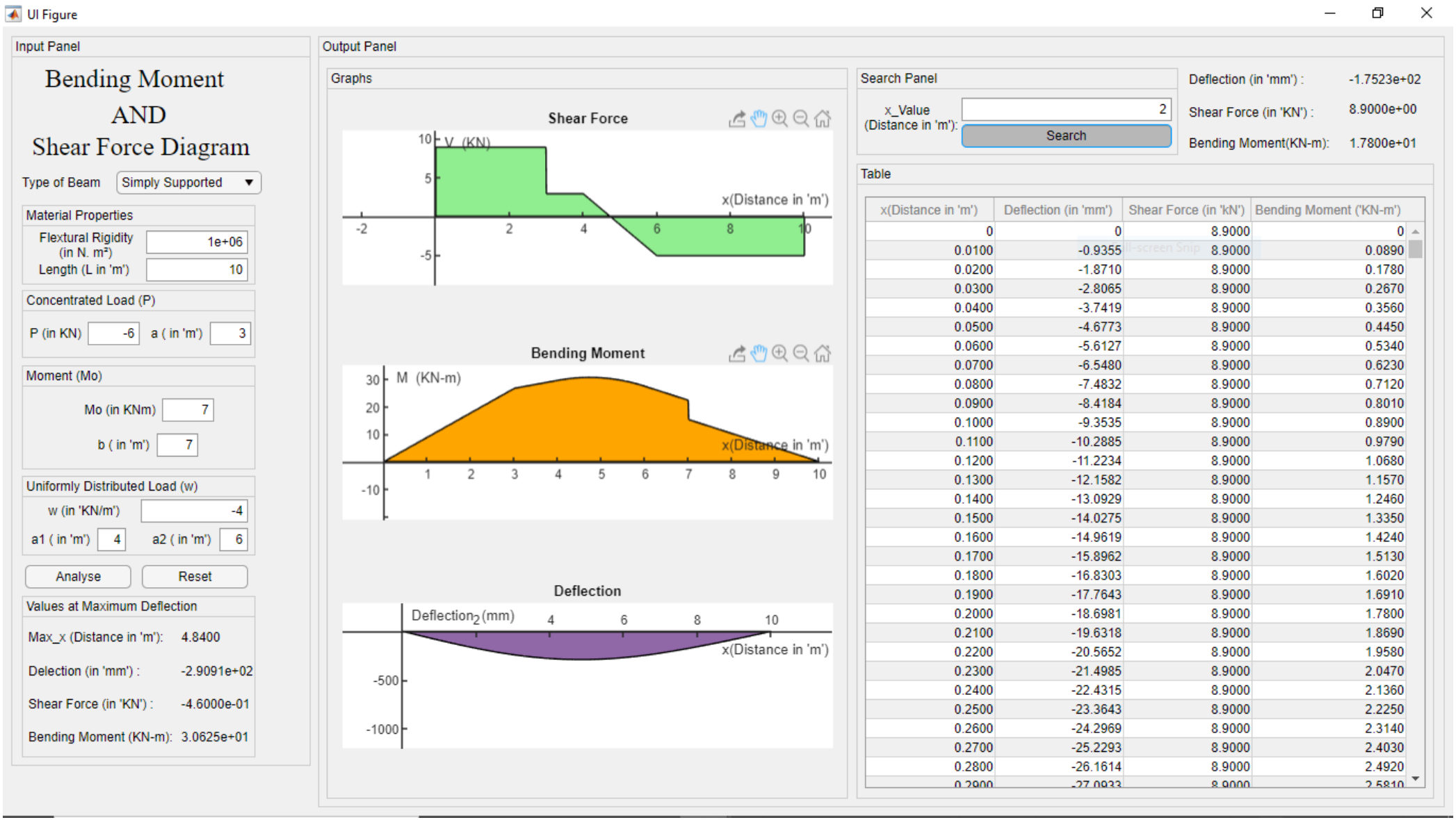
Shear Force (in 'KN') : 8.0000e-01

Bending Moment(KN-m): -2.4000e+00

Table

x(Distance in 'm')	Deflection (in 'mm')	Shear Force (in 'kN')	Bending Moment ('KN-m')
0	0	-3.2000	0
0.0100	0.0480	-3.2000	-0.0320
0.0200	0.0960	-3.2000	-0.0640
0.0300	0.1440	-3.2000	-0.0960
0.0400	0.1920	-3.2000	-0.1280
0.0500	0.2399	-3.2000	-0.1600
0.0600	0.2879	-3.2000	-0.1920
0.0700	0.3358	-3.2000	-0.2240
0.0800	0.3837	-3.2000	-0.2560
0.0900	0.4316	-3.2000	-0.2880
0.1000	0.4795	-3.2000	-0.3200
0.1100	0.5273	-3.2000	-0.3520
0.1200	0.5751	-3.2000	-0.3840
0.1300	0.6228	-3.2000	-0.4160
0.1400	0.6705	-3.2000	-0.4480
0.1500	0.7182	-3.2000	-0.4800
0.1600	0.7658	-3.2000	-0.5120
0.1700	0.8134	-3.2000	-0.5440
0.1800	0.8609	-3.2000	-0.5760
0.1900	0.9083	-3.2000	-0.6080
0.2000	0.9557	-3.2000	-0.6400
0.2100	1.0031	-3.2000	-0.6720
0.2200	1.0503	-3.2000	-0.7040
0.2300	1.0975	-3.2000	-0.7360
0.2400	1.1446	-3.2000	-0.7680
0.2500	1.1917	-3.2000	-0.8000
0.2600	1.2386	-3.2000	-0.8320
0.2700	1.2855	-3.2000	-0.8640
0.2800	1.3323	-3.2000	-0.8960
0.2900	1.3790	-3.2000	-0.9280

Problem 1


UI Figure
Input Panel
Bending Moment
AND
Shear Force Diagram
Type of Beam
Simply Supported
Material Properties
Flextural Rigidity (in N. m²)
1e+06
Length (L in 'm')
10
Concentrated Load (P)
P (in KN)
-6
a (in 'm')
3
Moment (Mo)
Mo (in KNm)
7
b (in 'm')
7
Uniformly Distributed Load (w)
w (in 'KN/m')
-4
a1 (in 'm')
4
a2 (in 'm')
6
Analyse
Reset
Values at Maximum Deflection
Max_x (Distance in 'm'): 4.8400
Delection (in 'mm') : -2.9091e+02
Shear Force (in 'KN') : -4.6000e-01
Bending Moment (KN-m): 3.0625e+01
Output Panel
Graphs
Shear Force
V (KN)
x(Distance in 'm')
Bending Moment
M (KN-m)
x(Distance in 'm')
Deflection
Deflection (mm)
x(Distance in 'm')
Search Panel
x_Value (Distance in 'm'):
2
Search
Deflection (in 'mm') : -1.7523e+02
Shear Force (in 'KN') : 8.9000e+00
Bending Moment(KN-m): 1.7800e+01
Table
x(Distance in 'm') | Deflection (in 'mm') | Shear Force (in 'kN') | Bending Moment ('KN-m')
0 | 0 | 8.9000 | 0
0.0100 | -0.9355 | 8.9000 | 0.0890
0.0200 | -1.8710 | 8.9000 | 0.1780
0.0300 | -2.8065 | 8.9000 | 0.2670
0.0400 | -3.7419 | 8.9000 | 0.3560
0.0500 | -4.6773 | 8.9000 | 0.4450
0.0600 | -5.6127 | 8.9000 | 0.5340
0.0700 | -6.5480 | 8.9000 | 0.6230
0.0800 | -7.4832 | 8.9000 | 0.7120
0.0900 | -8.4184 | 8.9000 | 0.8010
0.1000 | -9.3535 | 8.9000 | 0.8900
0.1100 | -10.2885 | 8.9000 | 0.9790
0.1200 | -11.2234 | 8.9000 | 1.0680
0.1300 | -12.1582 | 8.9000 | 1.1570
0.1400 | -13.0929 | 8.9000 | 1.2460
0.1500 | -14.0275 | 8.9000 | 1.3350
0.1600 | -14.9619 | 8.9000 | 1.4240
0.1700 | -15.8962 | 8.9000 | 1.5130
0.1800 | -16.8303 | 8.9000 | 1.6020
0.1900 | -17.7643 | 8.9000 | 1.6910
0.2000 | -18.6981 | 8.9000 | 1.7800
0.2100 | -19.6318 | 8.9000 | 1.8690
0.2200 | -20.5652 | 8.9000 | 1.9580
0.2300 | -21.4985 | 8.9000 | 2.0470
0.2400 | -22.4315 | 8.9000 | 2.1360
0.2500 | -23.3643 | 8.9000 | 2.2250
0.2600 | -24.2969 | 8.9000 | 2.3140
0.2700 | -25.2293 | 8.9000 | 2.4030
0.2800 | -26.1614 | 8.9000 | 2.4920

Problem 2

UI Figure

Input Panel

Bending Moment AND Shear Force Diagram

Type of Beam: Cantilever

Material Properties

Flextural Rigidity (in N. m²)	1e+06
Length (L in 'm')	10

Concentrated Load (P)

P (in KN): -6 a (in 'm'): 3

Moment (Mo)

Mo (in KNm): 0

b (in 'm'): 0

Uniformly Distributed Load (w)

w (in 'KN/m'): 0

a1 (in 'm'): 0 a2 (in 'm'): 0

Analyse | Reset

Values at Maximum Deflection

Max_x (Distance in 'm'): 0.0000

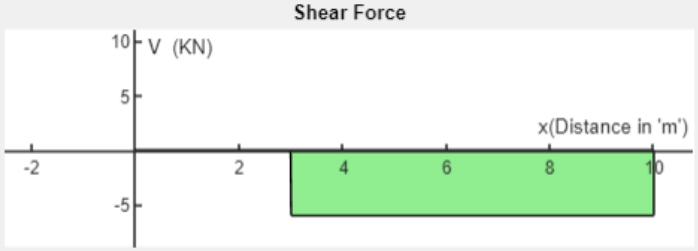
Delection (in 'mm') : -1127

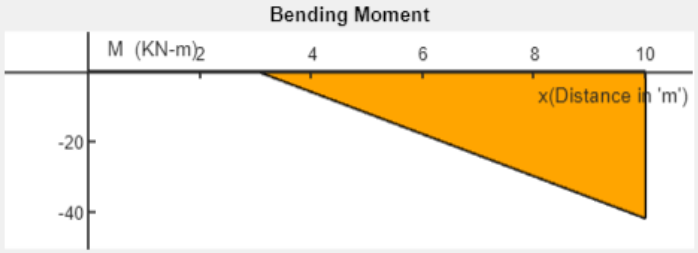
Shear Force (in 'KN') : 0000

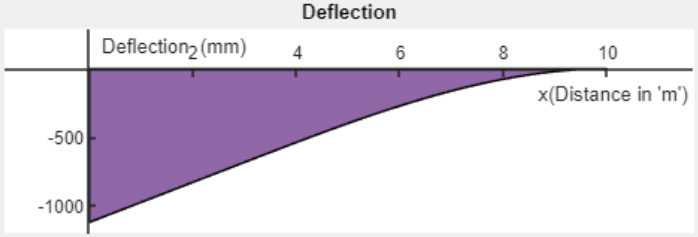
Bending Moment (KN-m): 0000

Output Panel

Graphs







Search Panel

x_Value (Distance in 'm'): 2

Search

Deflection (in 'mm') : -0833

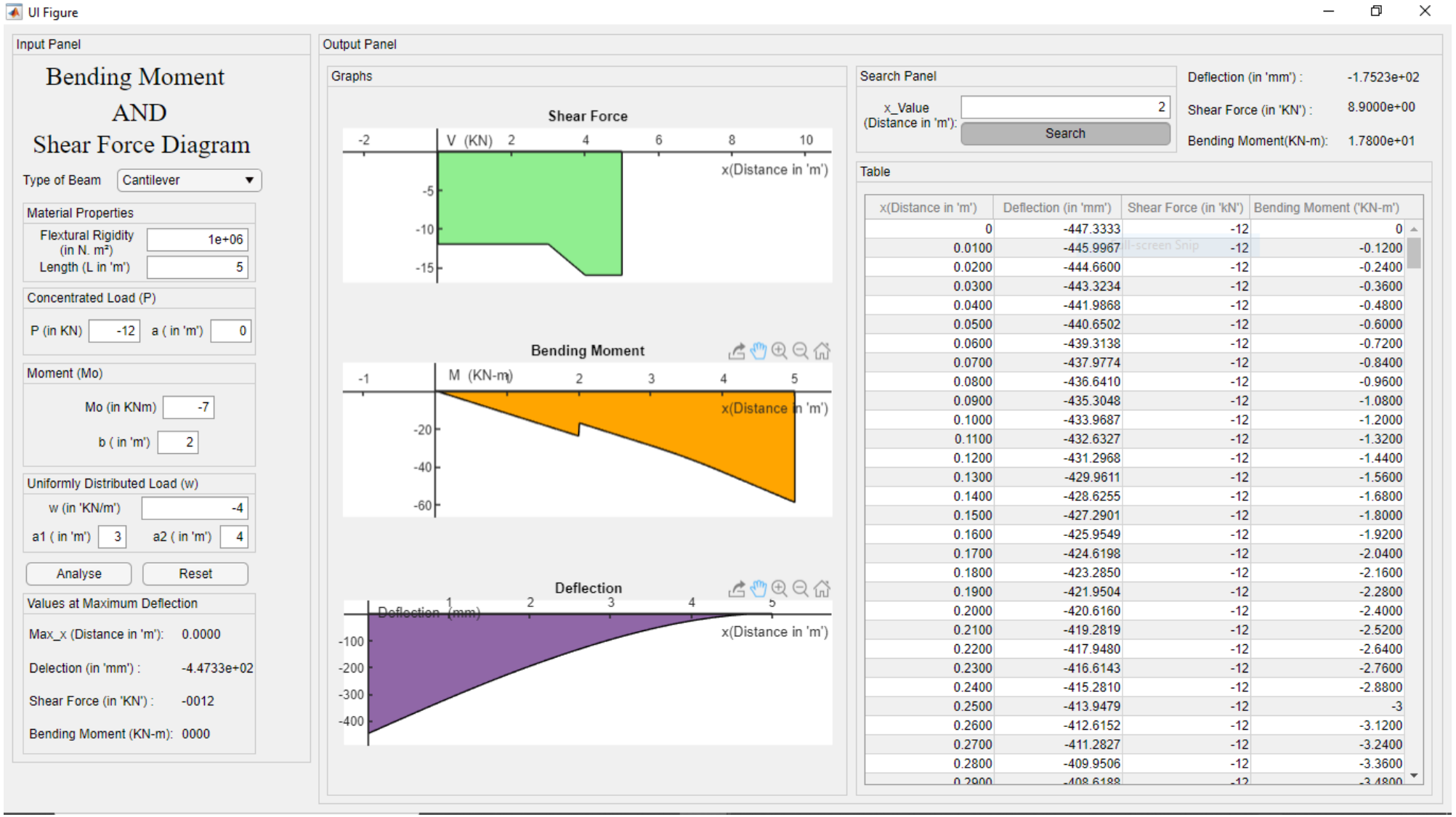
Shear Force (in 'KN') : 0000

Bending Moment(KN-m): 0000

Table

x(Distance in 'm')	Deflection (in 'mm')	Shear Force (in 'kN')	Bending Moment ('KN-m')
0	-1127	0	0
0.0100	-1.1255e+03	0	0
0.0200	-1.1241e+03	0	0
0.0300	-1.1226e+03	0	0
0.0400	-1.1211e+03	0	0
0.0500	-1.1197e+03	0	0
0.0600	-1.1182e+03	0	0
0.0700	-1.1167e+03	0	0
0.0800	-1.1152e+03	0	0
0.0900	-1.1138e+03	0	0
0.1000	-1.1123e+03	0	0
0.1100	-1.1108e+03	0	0
0.1200	-1.1094e+03	0	0
0.1300	-1.1079e+03	0	0
0.1400	-1.1064e+03	0	0
0.1500	-1.1050e+03	0	0
0.1600	-1.1035e+03	0	0
0.1700	-1.1020e+03	0	0
0.1800	-1.1005e+03	0	0
0.1900	-1.0991e+03	0	0
0.2000	-1.0976e+03	0	0
0.2100	-1.0961e+03	0	0
0.2200	-1.0947e+03	0	0
0.2300	-1.0932e+03	0	0
0.2400	-1.0917e+03	0	0
0.2500	-1.0903e+03	0	0
0.2600	-1.0888e+03	0	0
0.2700	-1.0873e+03	0	0
0.2800	-1.0858e+03	0	0
0.2900	-1.0844e+03	0	0

Problem 3



x(Distance in 'm')	Deflection (in 'mm')	Shear Force (in 'kN')	Bending Moment ('KN-m')
0	-447.3333	-12	0
0.0100	-445.9967	-12	-0.1200
0.0200	-444.6600	-12	-0.2400
0.0300	-443.3234	-12	-0.3600
0.0400	-441.9868	-12	-0.4800
0.0500	-440.6502	-12	-0.6000
0.0600	-439.3138	-12	-0.7200
0.0700	-437.9774	-12	-0.8400
0.0800	-436.6410	-12	-0.9600
0.0900	-435.3048	-12	-1.0800
0.1000	-433.9687	-12	-1.2000
0.1100	-432.6327	-12	-1.3200
0.1200	-431.2968	-12	-1.4400
0.1300	-429.9611	-12	-1.5600
0.1400	-428.6255	-12	-1.6800
0.1500	-427.2901	-12	-1.8000
0.1600	-425.9549	-12	-1.9200
0.1700	-424.6198	-12	-2.0400
0.1800	-423.2850	-12	-2.1600
0.1900	-421.9504	-12	-2.2800
0.2000	-420.6160	-12	-2.4000
0.2100	-419.2819	-12	-2.5200
0.2200	-417.9480	-12	-2.6400
0.2300	-416.6143	-12	-2.7600
0.2400	-415.2810	-12	-2.8800
0.2500	-413.9479	-12	-3
0.2600	-412.6152	-12	-3.1200
0.2700	-411.2827	-12	-3.2400
0.2800	-409.9506	-12	-3.3600
0.2900	-408.6188	-12	-3.4800

Problem 4