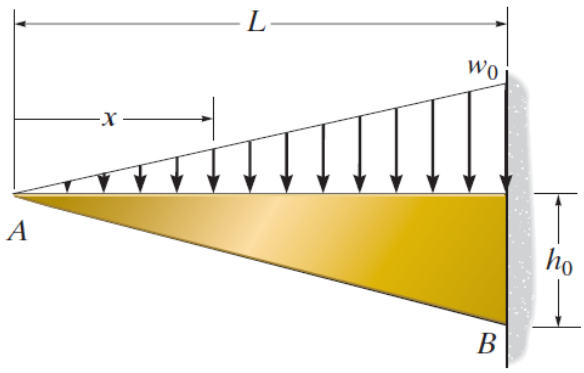
problem 12-143

12–143. If the cantilever beam has a constant thickness t, determine the deflection at end A. The beam is made of material having a modulus of elasticity E.



Prob. 12–143

beam

```
u = symunit;
x = sym('x');
E = sym('E');
wo = sym('wo');
L = sym('L');

old_assum = assumptions;
clearassum;
wf = findpoly(1, 'thru', [0 0], [L -wo], 'mode', 'factor');

b = beam;
b = b.add('reaction', 'force', 'Rb', L);
b = b.add('reaction', 'moment', 'Mb', L);
b = b.add('distributed', 'force', wf, [0 L]);
```

section properties

```
ho = sym('ho');
t = sym('t');
h(x,ho,L) = findpoly(1, 'thru', [0 0], [L ho], 'mode', 'factor');
b.I(x,ho,t,L) = t*h^3/12;
```

elastic curve

```
[y(x,E,ho,t,wo,L) dy(x,E,ho,t,wo,L) ...
 m(x,wo,L) v(x,wo,L) w(x,wo,L) r] = b.elastic_curve(x, 'factor'); %#ok
y
```

y(x, E, ho, t, wo, L) =

$$-\frac{L^2\,\mathrm{wo}\,(L-x)^2}{\mathrm{E}\,\mathrm{ho}^3\,t}$$

```
dy
```

dy(x, E, ho, t, wo, L) =

$$\frac{2\,L^2\,\mathrm{wo}\,(L-x)}{\mathrm{E}\,\mathrm{ho}^3\,t}$$

```
m
```

m(x, wo, L) =

$$-\frac{\mathrm{wo}\,x^3}{6\,L}$$

```
v
```

v(x, wo, L) =

$$-\frac{\mathrm{wo}\,x^2}{2\,L}$$

```
w
```

w(x, wo, L) =

$$-\frac{\mathrm{wo}\,x}{L}$$

reactions

```
Rb = r.Rb %#ok
```

Rb =

$$\frac{L\,\mathrm{wo}}{2}$$

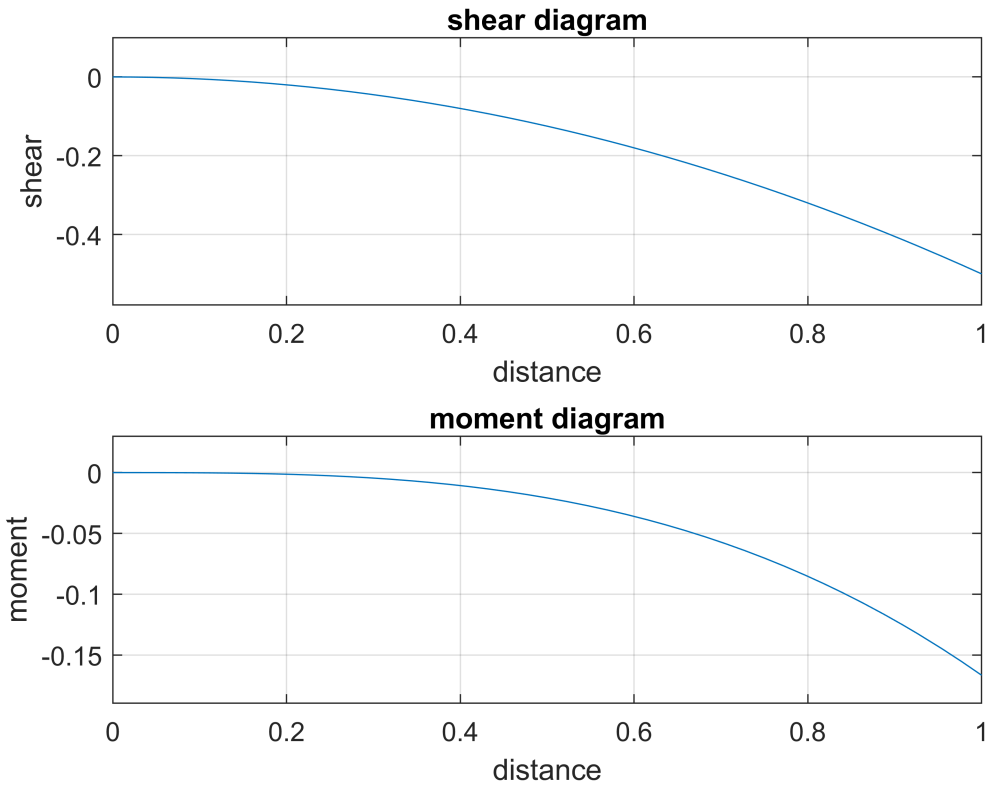
```
Mb = r.Mb %#ok
```

Mb =

$$-\frac{L^2\,\mathrm{wo}}{6}$$

shear and moment diagram

```
beam.shear_moment(m, v, [0 1], [wo L], 1);
subplot(2,1,1);
axis([0 1 -0.58 0.1]);
subplot(2,1,2);
axis([0 1 -0.19 0.03]);
```



deflection at point A

```
yA = y(0,E,ho,t,wo,L) %#ok
```

yA =

$$-\frac{L^4\,\mathrm{wo}}{\mathrm{E}\,\mathrm{ho}^3\,t}$$

clean up

```
setassum(old_assum);
clear old_assum Rb Mb yA;
```