SymBeam

SymBeam is a pedagogical Python package for bending diagrams computation, aimed at Mechanical, Civil and Industrial Engineering students.

In [1]:

```
#!pip install symbeam # uncomment the line if you need to install symbeam to Colab
%matplotlib inline
from symbeam import beam
```

In [2]:

```
# Define the length of the beam
new=beam(length = 'L')

# Set the Young modulus and second moment of area of beam segments
new.set_young(x_start = 0, x_end = 'L', value = 210e6)
new.set_inertia(x_start = 0, x_end = 'L', value = 5e-6)

# Add supports. Options are (pin, roller, hinge and fixed)
new.add_support(x_coord = 0, support_type = 'fixed')
new.add_support(x_coord = 'L/2', support_type = 'hinge')
new.add_support(x_coord = '3*L/4', support_type = 'roller')

# Add external loads. Loads can be (point_force, point_moment, or distributed_load)
new.add_point_load(x_coord = 'L', value = '-P')
new.add_point_moment(x_coord = 'L/4', value = 'P*L')
new.add_distributed_load(x_start = 0, x_end = 'L/2', expression = '-P * x / L')
```

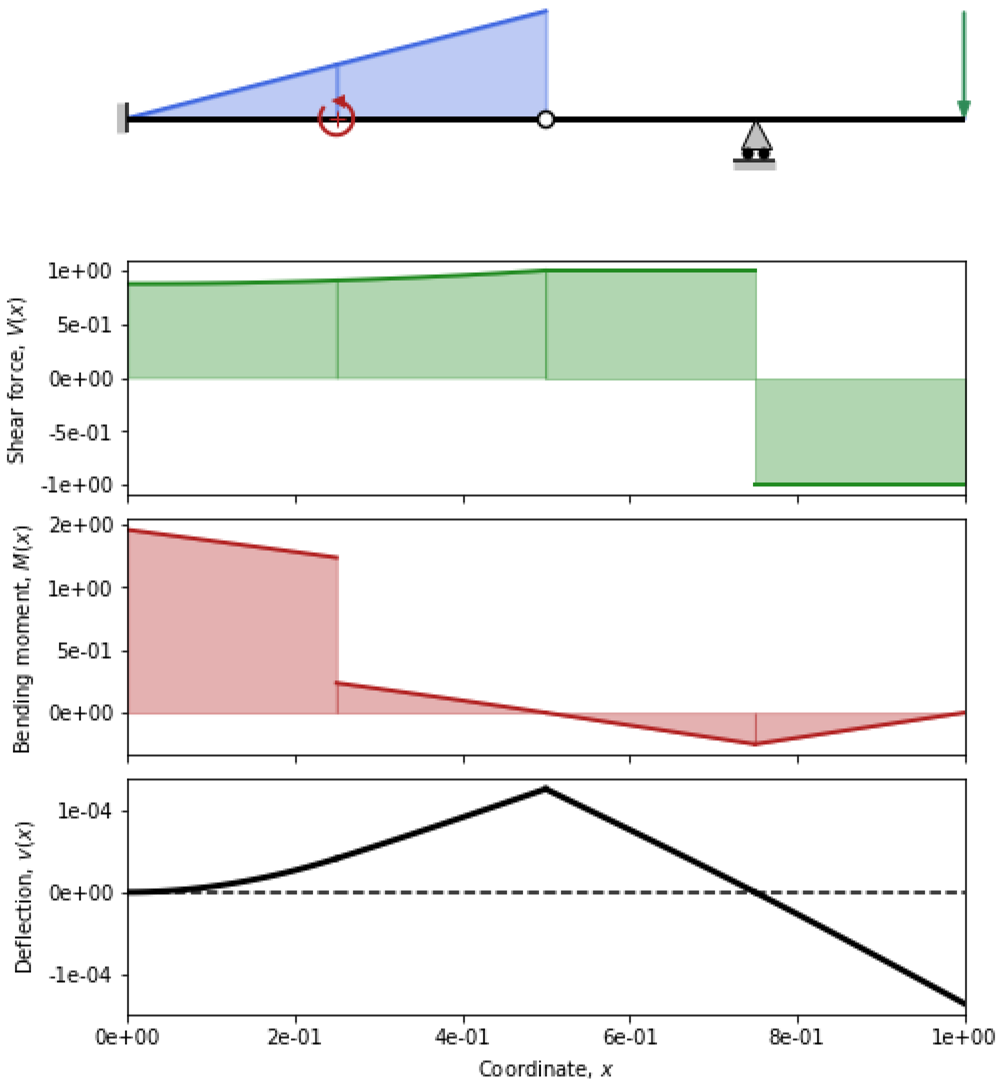
In [3]:

```
new.solve()
```

```
                                 Beam points
===================================================================================
     Coordinate              Type                Load                Moment
-----------------------------------------------------------------------------------
         0                   Fixed                0                    0
        L/4             Continuity point          0                   L*P
        L/2                  Hinge                0                    0
       3*L/4                 Roller               0                    0
         L              Continuity point          -P                   0
===================================================================================


                                Beam segments
===================================================================================
        Span           Young modulus           Inertia         Distributed load
-----------------------------------------------------------------------------------
 [   0   -  L/4  ]     210000000.000000   5.00000000000000e-6         -P*x/L
 [  L/4  -  L/2  ]     210000000.000000   5.00000000000000e-6         -P*x/L
 [  L/2  - 3*L/4 ]     210000000.000000   5.00000000000000e-6           0
 [ 3*L/4 -    L  ]     210000000.000000   5.00000000000000e-6           0
===================================================================================


                             Exterior Reactions
===================================================================================
           Point                         Type                        Value
-----------------------------------------------------------------------------------
             0                          Force                     L*P/8 - P
             0                          Moment               L**2*P/24 - 3*L*P/2
           3*L/4                        Force                        2*P
===================================================================================


                               Internal Loads
===================================================================================
        Span          Diagram                        Expression
-----------------------------------------------------------------------------------
 [   0   -  L/4  ]      V(x)               P*(8 - L)/8 + P*x**2/(2*L)
 [   0   -  L/4  ]      M(x)      L*P*(36 - L)/24 + x*(L*P/8 - P) - P*x**3/(6*L)
-----------------------------------------------------------------------------------
 [  L/4  -  L/2  ]      V(x)               P*(8 - L)/8 + P*x**2/(2*L)
 [  L/4  -  L/2  ]      M(x)      L*P*(12 - L)/24 + x*(L*P/8 - P) - P*x**3/(6*L)
-----------------------------------------------------------------------------------
 [  L/2  - 3*L/4 ]      V(x)                              P
 [  L/2  - 3*L/4 ]      M(x)                          L*P/2 - P*x
-----------------------------------------------------------------------------------
 [ 3*L/4 -    L  ]      V(x)                              -P
 [ 3*L/4 -    L  ]      M(x)                          -L*P + P*x
===================================================================================


                           Rotation and deflection
===================================================================================
        Span          Variable                       Expression
-----------------------------------------------------------------------------------
 [   0   -  L/4  ]      v(x)     x**3*(1.98412698412698e-5*L*P - 0.000158730158730159*P) + x**2*(-1.98412698412698e-5*L**2*P + 0.000
714285714285714*L*P) - 7.93650793650794e-6*P*x**5/L
 [   0   -  L/4  ]    dv/dx(x)  x**2*(5.95238095238095e-5*L*P - 0.000476190476190476*P) + x*(-3.96825396825397e-5*L**2*P + 0.001428
57142857143*L*P) - 3.96825396825397e-5*P*x**4/L
-----------------------------------------------------------------------------------
 [  L/4  -  L/2  ]      v(x)     -2.97619047619048e-5*L**3*P + 0.000238095238095238*L**2*P*x + x**3*(1.98412698412698e-5*L*P - 0.000
158730158730159*P) + x**2*(-1.98412698412698e-5*L**2*P + 0.000238095238095238*L*P) - 7.93650793650794e-6*P*x**5/L
 [  L/4  -  L/2  ]    dv/dx(x)  0.000238095238095238*L**2*P + x**2*(5.95238095238095e-5*L*P - 0.000476190476190476*P) + x*(-3.96825
396825397e-5*L**2*P + 0.000476190476190476*L*P) - 3.96825396825397e-5*P*x**4/L
-----------------------------------------------------------------------------------
 [  L/2  - 3*L/4 ]      v(x)     -8.18452380952381e-6*L**4*P + 0.000401785714285714*L**3*P + 0.000238095238095238*L*P*x**2 - 0.00015
8730158730159*P*x**3 + 1.0*x*(1.09126984126984e-5*L**3*P - 0.000625*L**2*P)
 [  L/2  - 3*L/4 ]    dv/dx(x)  1.09126984126984e-5*L**3*P - 0.000625*L**2*P + 0.000476190476190476*L*P*x - 0.000476190476190476*P*
x**2
-----------------------------------------------------------------------------------
 [ 3*L/4 -    L  ]      v(x)     -8.18452380952381e-6*L**4*P + 0.000267857142857143*L**3*P - 0.000476190476190476*L*P*x**2 + 0.00015
8730158730159*P*x**3 + 1.0*x*(1.09126984126984e-5*L**3*P - 8.92857142857143e-5*L**2*P)
 [ 3*L/4 -    L  ]    dv/dx(x)  1.09126984126984e-5*L**3*P - 8.92857142857143e-5*L**2*P - 0.000952380952380952*L*P*x + 0.0004761904
76190476*P*x**2
===================================================================================
```

In [4]:
```python
new.plot()
```

Out[4]:
```
(<Figure size 504x576 with 4 Axes>,
 [<Axes: >,
  <Axes: ylabel='Shear force, $V(x)$'>,
  <Axes: ylabel='Bending moment, $M(x)$'>,
  <Axes: xlabel='Coordinate, $x$', ylabel='Deflection, $v(x)$'>])
```


1e+00
5e-01
0e+00
-5e-01
-1e+00
Shear force, $V(x)$
2e+00
1e+00
5e-01
0e+00
Bending moment, $M(x)$
1e-04
0e+00
-1e-04
Deflection, $v(x)$
0e+00
2e-01
4e-01
6e-01
8e-01
1e+00
Coordinate, x