Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Student number\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Assignment 1**

Consider the beam loaded by its own weight as shown in the figure. Thickness*,* width, and length of the beam are , , and *L*, respectively. Density , Young’s modulus , and Poisson’s ratio are constants. Find the unknown parameter  of the assumed transverse displacement . The origin of the material coordinate system is placed at the symmetry axes of the rectangular cross section.

*L*

*x*

*z*

*g*

**Solution template**

Virtual work density expressions of the beam bending mode are

 and ,

in which  is the component of the external force per unit length,  is the Young’s modulus of the material, and  the second moment of area with respect to the area centroid.

With the displacement assumption  and the expression of , virtual work densities simplify to

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Integration over the length of the beam gives the virtual work expressions

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Finally, principle of virtual work with  and the fundamental lemma of variation calculus imply the solution

  

 

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