

Name_____ Student number_____

Assignment 2 (2p)

Find the displacement $u(x)$ of a bar of length L using the boundary value problem

$$EA \frac{d^2 u}{dx^2} + \rho A g = 0 \quad x \in]0, L[, \quad u(0) = u(L) = 0$$

given by the continuum model. Assume that the cross-sectional area A , Young's modulus E of the material, density ρ of the material, and acceleration by gravity g are constants.

Solution template

First, repeated integrations with the differential equation are used to find the generic solution. Let the integration constants be a and b :

$$\frac{d^2 u}{dx^2} = -\frac{\rho A g}{EA} \Rightarrow \frac{du}{dx} = \underline{\hspace{2cm}} \Rightarrow u(x) = \underline{\hspace{2cm}} .$$

Second, boundary conditions are used to find the values of the integration constants a and b :

$$u(0) = \underline{\hspace{2cm}} = 0 \quad \text{and} \quad u(L) = \underline{\hspace{2cm}} = 0 \Rightarrow$$

$$b = \underline{\hspace{2cm}} \quad \text{and} \quad a = \underline{\hspace{2cm}} .$$

Finally, the values of the integration constants are substituted into the generic solution to get the solution:

$$u(x) = \underline{\hspace{2cm}} . \quad \leftarrow$$