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

2

*L*

1

*x,X*

**Assignment 2**

Assuming that node 1 of the bar shown is fixed, derive the expression of the axial displacement  at the free end for . The initial conditions at  are  and .

**Solution template**

Virtual work expression of internal and inertia forces of the bar model is given by



in which  is the cross-sectional area, *E* is the Young’s modulus, and *ρ* is the density of the material. In terms of the displacement components of the structural coordinate system



.



Initial value problem, consisting of an ordinary differential equation (implied by the virtual work expression) and initial conditions, is given by

 ,

 and  .

Expression , which describes a harmonic periodic motion, satisfies all the equations with selections

 and . 🡸