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

**Assignment 1**

Find the displacement  of the bar shown. Left end of the bar (node 1) is fixed and the given external force  is acting on node 2. Young’s modulus  and cross-sectional area  are constants and distributed force .

*E,A*

*P*

*L*

1

2

*x,X*



1

*z,Z*

**Solution template**

The bar element contribution is

,

in which  is the cross-sectional area, *E* is the Young’s modulus, and  is the external distributed force in direction. The point force/moment element contribution is given by

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When the known nodal displacement of node 1 and the relationship  are used there, the bar element contribution (element 1 here) simplifies to



The force element contribution (element 2 here) simplifies to

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Virtual work expression of a structure is the sum of the element contributions

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Principle of virtual work and the fundamental lemma of variation calculus imply the equilibrium equation

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Solution to the nodal displacement is given by

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