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

**Assignment 1**

Consider the bar structure below and solve for the displacement  at node 2. 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.

*EA*

*P*

*L*

1

2

1

*x,X*

*z,Z*

**Solution template**

The generic force-displacement relationship of a bar element

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depends on the cross-sectional area , Young’s modulus ,bar length, and force per unit length of the bar  in the direction of the axis.

Free body diagrams of the bar element and the two nodes. External given force  and the constraint force  are acting on the nodes and the material and structural coordinate systems coincide:

*EA*

*L*

*P*



2

1

1

*FX*1

*FX*1

Equilibrium equations of nodes 1 and 2, and the force-displacement relationship of element 1 (from the figure ,,, and )

Node 1 : ,

Node 2 : ,

Bar 1 : .

Equilibrium equations of node 2 can be solved for the displacement when the internal forces are first eliminated by using the bar element contribution. After elimination

Node 2 : .

Therefore, solution to the unknown displacement

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