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

**Assignment 4**

Beam structure of the figure is loaded by a point moment acting on node 2. Determine the rotations  and  by using two beam bending elements. Displacements are confined to the *XZ*-plane. The cross-section properties of the beam *A*, *I* and Young’s modulus of the material *E* are constants.

*L*

3

1

*M*

*z,Z*

*x,X*

2

*L*

1

2

**Solution template**

Virtual work expression for the displacement analysis consists of parts coming from internal and external forces. For the beam bending mode in *xz*-plane, the element contribution is

****.

The element contribution of the point force/moment follows from the definition or work and is given by

.

For beam 1, the element contribution simplifies to

****.

For beam 2, the element contribution is given by

****.

Virtual work expression of the point moment (considered as element 3) takes the form

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Virtual work expression of structure is sum of the element contributions. In the standard form

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Principle of virtual work and the fundamental lemma of variation calculus imply that

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Solution to the linear equation system is given by

 and . 🡸

Use the code of MEC-E1050 to check your solution!