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

*L*

1

2

*p*

*z,Z*

*x,X*

1

**Assignment 2**

Determine the buckling force  of the structure shown by using one beam element. Displacements are confined to the plane. Parameters *E, A,* and *I* are constants.

**Solution template**

The normal force in the beam



can be deduced without calculations on the axial displacement. Therefore, it is enough to consider only the bending and coupling terms of the virtual work expression. As displacement is confined to the plane and the beam is simply supported, virtual work expression



simplifies to

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According to the principle of virtual work and the fundamental lemma of variational calculation

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A homogeneous linear equation system has a non-trivial solution only if the matrix is singular (notice that equation of the form  implies )

 

or .

The critical loading is given by the smallest of the buckling forces. Therefore

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