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

**Assignment 4**

The bar shown consists of two elements having different cross-sectional areas , . Material properties *E*, *k*, and *α* are the same. Determine the stationary displacement  and temperature  at node 2, when the temperature at the left wall (node 1) is  and that of the right wall is  (node 3). Stress vanishes, when the temperature in the wall and bar is .

*L*

*x,X*

2

1

2

*L*

1

3

**Solution template**

Element contribution of a bar needed in this case are

, ,

.

The expressions assume linear approximations and constant material properties. The temperature relative to the initial temperature without stress is denoted by . The unknown nodal displacement and temperature are and .

When the nodal displacements and temperatures are substituted there, the element contributions of bar 1 take the forms

,

.

When the displacements and temperatures are substituted there, the element contributions of bar 2 take the forms

,

.

Virtual work expression is the sum of element contributions

,

.

Variational principle  and   gives a linear equation system

 

 and . 🡸