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

**Assignment 1 (2p)**

Principle of virtual work for a bar problem is given by: find  such that 



in which . Assuming that ,  and *F* are given constants, deduce the underlying boundary value problem for . Use integration by parts in the first term and the fundamental lemma of variation calculus to deduce the implications of principle of virtual work.

**Solution**

Integration by parts in the first term gives an equivalent form. Notice that variation 

 

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According to principle of virtual work  . Let us first consider a subset of  for which  so that the boundary terms vanish. Then, the fundamental lemma of variation calculus implies that

    in .

After that, let us consider the original set  and simplify the virtual work expression by using the equilibrium equation already obtained. Then, the fundamental lemma of variation calculus implies

    at .

Boundary value problem consist of the equations obtained and the constraint for the function set

 in , (differential equation) **🡸**

 at  and  at . (boundary conditions) **🡸**