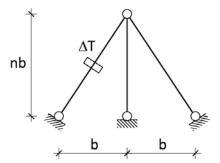
Politecnico di Milano, Master of Science in Civil Engineering for Risk Mitigation Course Computational Mechanics - A.A. 2021/2022 - Prof. Gabriella Bolzon

Supplementary Exercises – set E - winter set

STUDENT IDENTIFICATION NUMBER: ___

abcdef

Exercise 1



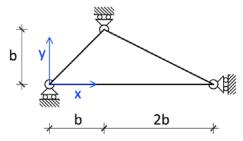
е	0	1	2	3	4	5	6	7	8	9
n	$\frac{21}{20}$	$\frac{55}{48}$	$\frac{4}{3}$		$\frac{56}{33}$	15 8	$\frac{77}{36}$		$\frac{35}{12}$	$\frac{24}{7}$

Consider the above structure with the indicated dimensions (see the Table, where e coincides with the corresponding digit of your student id number), subjected to the indicated temperature change. All structural elements have the same axial stiffness EA and thermal expansion coefficient α .

- Individuate the free degrees of freedom of the system.
- Evaluate the strain energy stored in the structure as a function of the free displacements only.
- Use the strain energy expression to derive the equilibrium equations, and solve to get the unknown displacement components.
- Sketch the deformed configuration of the structure.
- Graphically represent the internal forces distribution.

Solve the exercise and deliver only next page 2 fully compiled.

Exercise 2



Consider the homogeneous triangular region sketched above, with the indicated dimensions, subjected to the volume load distribution (x horizontal direction, y vertical direction):

$$F_{\rm x} = p \cdot \left(1 + m \cdot \frac{\rm y}{\rm b}\right) \qquad F_{\rm y} = p \cdot \left(2 - m \cdot \frac{\rm y}{\rm b}\right) \qquad {\rm with} \quad m = \frac{1 + 2 \cdot f}{10}$$

where *f* coincides with the corresponding digit of your student id number.

Assume plane strain condition, out of plane thickness h, elastic parameters E, v=0.2.

- Individuate the free degrees of freedom of the system.
- Express the displacement field as a function of the free displacement components.
- Evaluate the strain energy stored in the structure as a function of the free displacements only.
- Use the strain energy expression to derive the equilibrium equations, and solve to get the unknown displacement components.
- Sketch the deformed configuration of the region.
- Compute ALL the non-null stress and strain components in the element.

Solve the exercise and deliver only next page 3 fully compiled.

The delivery must follow the instructions contained in the document "Delivery Deadlines" published in WeBeep.

Supplementary Exercises – set E - winter set - SOLUTION					
Exercise 1 NODE NUMBERING & FREE DEGREES OF FREEDOM (sketch	n)				
n =					
STRAIN ENERGY EXPRESSION					
EQUILIBRIUM EQUATIONS					
•					
DISPLACEMENT VALUES	DEFORMED CONFIGURATION (quoted sketch)				
DIAGRAM OF INTERNAL FORCES					

NODE NUMBERING & FREE DEGREES OF FREEDOM (sketch)						
m =						
DISPLACEMENT FIELD AS A FUNCTION OF FREE DISPLACEN	<i>MENTS</i>					
STRAIN ENERGY EXPRESSION						
EQUILIBRIUM EQUATIONS						
DISPLACEMENT VALUES	DEFORMED CONFIGURATION (quoted sketch)					
DISPLACEIVIENT VALUES	DEFORMED CONFIGURATION (quoteu sketcii)					
CTDAIN EXPRESSIONS						
STRAIN EXPRESSIONS						
STRESS EXPRESSIONS						

Exercise 2