Assignment 3.1

On “The Plane Stress Problem”:

In isotropic elastic materials (as well as in plasticity and viscoelasticity) it is convenient to use the so-called Lamé constants λ and μ instead of E and ν in the constitutive equations. Both λ and μ have the physical dimension of stress and are related to E and ν by

$$\lambda = \frac{E\nu}{(1+\nu)(1-2\nu)} \quad \mu = G = \frac{E}{2(1+\nu)}$$

1. Find the inverse relations for E,ν in terms of λ,μ.
2. Express the elastic matrix for plane stress and plane strain cases in terms of λ,μ.
3. Split the stress-strain matrix E for plane strain as

$$\boldsymbol{E} = \boldsymbol{E}_{\boldsymbol{\lambda}} + \boldsymbol{E}_{\boldsymbol{\mu}}$$

in which Eμ and E_λ contain only μ and λ, respectively.

This is the Lamé {λ,μ} splitting of the plane strain constitutive equations, which leads to the so-called B-bar formulation of near-incompressible finite elements.

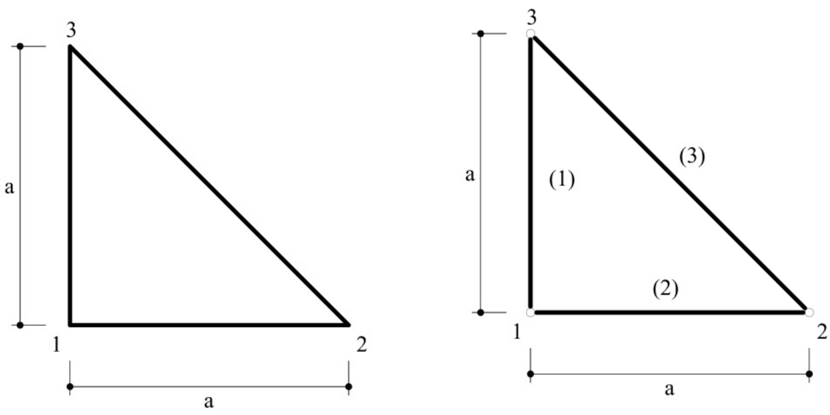
4. Express E_λ and E_μ also in terms of E and ν.

Assignment 3.2

On “The 3-node Plane Stress Triangle”:

Consider a plane triangular domain of thickness h, with horizontal and vertical edges of length a. Let us consider for simplicity a = 1, h = 1. The material parameters are E, ν. Initially ν is set to zero. Two discrete structural models are considered as depicted in the figure:

a) A plane linear Turner triangle with the same dimensions.
b) A set of three bar elements placed over the edges of the triangular domain. The cross sections for the bars are $A_1 = A_2$ and A_3.



1. Calculate the stiffness matrices $\boldsymbol{K}_{tri}$ and $\boldsymbol{K}_{bar}$ for both discrete models.
2. Is there any set of values for the cross sections A_1=A_2 and A_3 to make both stiffness matrix equivalent: $\boldsymbol{K}_{bar} = \boldsymbol{K}_{tri}$? If not, which are the values that make them more similar?
3. Why these two stiffness matrices are not equal?. Find a physical explanation.
4. Consider nowidering ν≠ 0 and extract some conclusions.

Date of Assignment: 19 / 02 / 2018
Date of Submission: 26 / 02 / 2018

The assignment must be submitted as a pdf file named **As3-Surname.pdf** to the CIMNE virtual center.