University POLITEHNICA of Bucharest
Mechanics of Materials Laboratory

Student _____

Faculty_____Year_____Group ____

Date_____

EXPERIMENTAL DETERMINATION OF YOUNG'S MODULUS AND POISSON'S RATIO

Aim of tests::

To present the strain gauge measurements for obtaining the elastic constants of a material:

E – Young's modulus,

ν - Poisson's ratio

The specimen

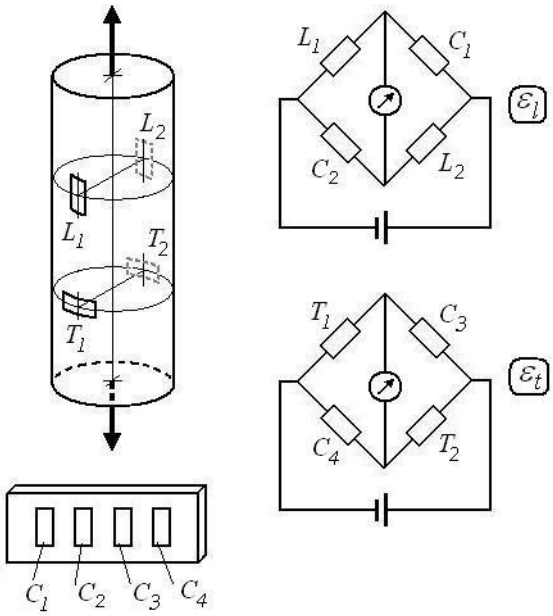
Material : OLC 45

Diameter of the specimen: d = 16 mm

Cross section area: A = _____ mm²

Strain gauge constant: k_t = 2.05

(the constant of the strain gauge bridge is set to $k_a = k_t = 2.05$)



Active and dummy strain gauges and strain gauge bridges for measurement of the longitudinal and transversal strains

Formulae

For a variation of the applied force in steps of 2kN:

$(\Delta F_i) = F_i - F_{i-1} = 2000N,\ (i = 1,2,...,n)$,

the elastic constants are calculated using the equations:

$$E_i = \frac{(\Delta F)_i}{A(\Delta\varepsilon_l)_i} \cdot 10^6$$

$$\nu_i = -\frac{(\Delta\varepsilon_t)_i}{(\Delta\varepsilon_l)_i}$$

in which $(\Delta\varepsilon_l)_i$ and $(\Delta\varepsilon_t)_i$ are variations of the longitudinal and transversal strains (expressed in μm/m), obtained as a function of the values $(I_l)_i$ and $(I_t)_i$ and of the strain gauge bridges:

$$(\Delta\varepsilon_l)_i = \frac{1}{2} \cdot \frac{k_a}{k_t}\left[(I_l)_i - (I_l)_{i-1}\right],$$

$$(\Delta\varepsilon_t)_i = \frac{1}{2} \cdot \frac{k_a}{k_t}\left[(I_t)_i - (I_t)_{i-1}\right],\ (i = 1,2,...,n)$$

The average values of the elastic parameters E and ν for the studied material are finally calculated as:

$$E = \frac{1}{n}\sum_{i=1}^{n} E_i$$

$$\nu = \frac{1}{n}\sum_{i=1}^{n} \nu_i$$

The obtained values are compared with those currently used in strength calculations.

Results of tests

i	0	1	2	3	4	5
F_i [N]	2000	4000	6000	8000	10000	12000
ΔF_i [N]	-	2000	2000	2000	2000	2000
$(I_l)_i$ [μm/m]						
$(I_t)_i$ [μm/m]						
$(\Delta\varepsilon_l)_i$ [μm/m]	-					
$(\Delta\varepsilon_t)_i$ [μm/m]	-					
E_i [MPa]	-					
ν_i	-					

Average values: E = _____MPa, ν = _____

Observations

1. _____

2. _____

3. _____