University POLITEHNICA of Bucharest
Mechanics of Materials Laboratory

Student ____________________________
Faculty______________Year______Group _____
Date________________

EXPERIMENTAL DETERMINATION OF ELASTIC CHARACTERISTIC FOR HELICAL SPRINGS

Aim of tests:

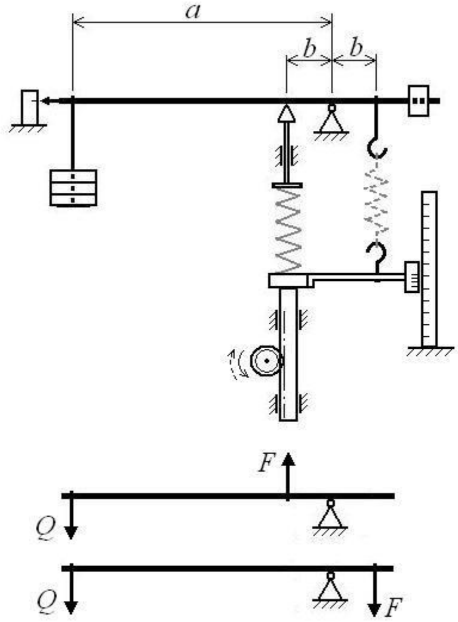
- To present the methodology of calibration for traction and compression springs
- Experimental validation of the relationships used to calculate the deflection of cylindrical and tapered helical springs

Calculus of the spring force when a weight Q is applied on the pan:

$$F = \frac{a}{b} \cdot Q = 10Q$$

Measurement of the extension/shortening of the spring is done using a caliper with 0.1mm precision. Values are read on the caliper scale when the loading lever is horizontal.

The testing machine



REISCHERTER machine for spring calibration

Relationships for deflection calculation:

- For cylindrical springs:

$$f_i = \frac{64 F_i R^3 n}{G d^4}$$

- For tapered springs:

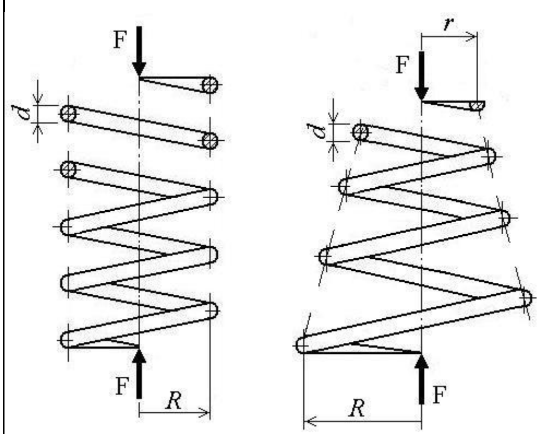
$$f_i = \frac{16 F_i \left(R^4 - r^4\right) n}{G d^4 \left(R - r\right)}$$

where n is the number of active windings and G is the shear modulus (G=8·10^{4}MPa)

Experimental results are processed using the formula

$$f_i = \left|C_i - C_0\right| \text{ , } i = 1, 2, \ldots, k$$

Where C_i is the value read for the loading with the force F_i and C_0 is the value read initially.



a *b*

Helical springs: a) cylindrical, b) tapered

Geometric characteristics of the springs:

A1) Cylindrical traction spring: d = 2 mm, R = 6.5 mm, n = 15 windings

A2) Cylindrical compression spring: d = 4 mm, R = 15 mm, n = 10 windings

A3) tapered compression spring: d = 3.5 mm, R = 12.5 mm, r = 9.5 mm, n = 12.5 windings

Experimental determinations

Type of spring	i	Q_i [N]	F_t [N]	C_i [mm]	$f_{i,\ measured}$ [mm]	$f_{i,\ calculated}$ [mm]	Error* [%]
A1	0	-	-		-	-	-
	1						
	2						
	3						
	4						
	5						
	6						
A2	0	-	-		-	-	-
	1						
	2						
	3						
	4						
	5						
	6						
A3	0	-	-		-	-	-
	1						
	2						
	3						
	4						
	5						
	6						

- The relative error is calculated using the formula: $e = \frac{f_{i,measured} - f_{i,calculated}}{f_{i,calculated}} \cdot 100[\%]$

Observations

1____

2____

3____