Lecture 2.
Tension and compression

Assos. Prof. A.Kutsenko

Plan of lecture

- 1. **Internal effects of force. Method of section**
- 2. **Stresses in the body, which under tension (compression)**
- 3. **Mechanical properties of materials by tension (compression).**

REFERENCES

- 1. Beer F.P., Johnston E.R., et. al.: Mechanics of materials. Graw – Hill. Inc., 2012. – 838 p
- 2. Sharma S.C.: Strength_of_materials. Web Course. http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IITROORKEE/ strength%20of%20materials /homepage.htm
- 3. Mechanics of materials: Theory and Problems. Manual. / A. Kutsenko, M. Bondar, V.Prishlyak – Kyiv. 2016 – 359 p.

Internal effects of force. Method of section

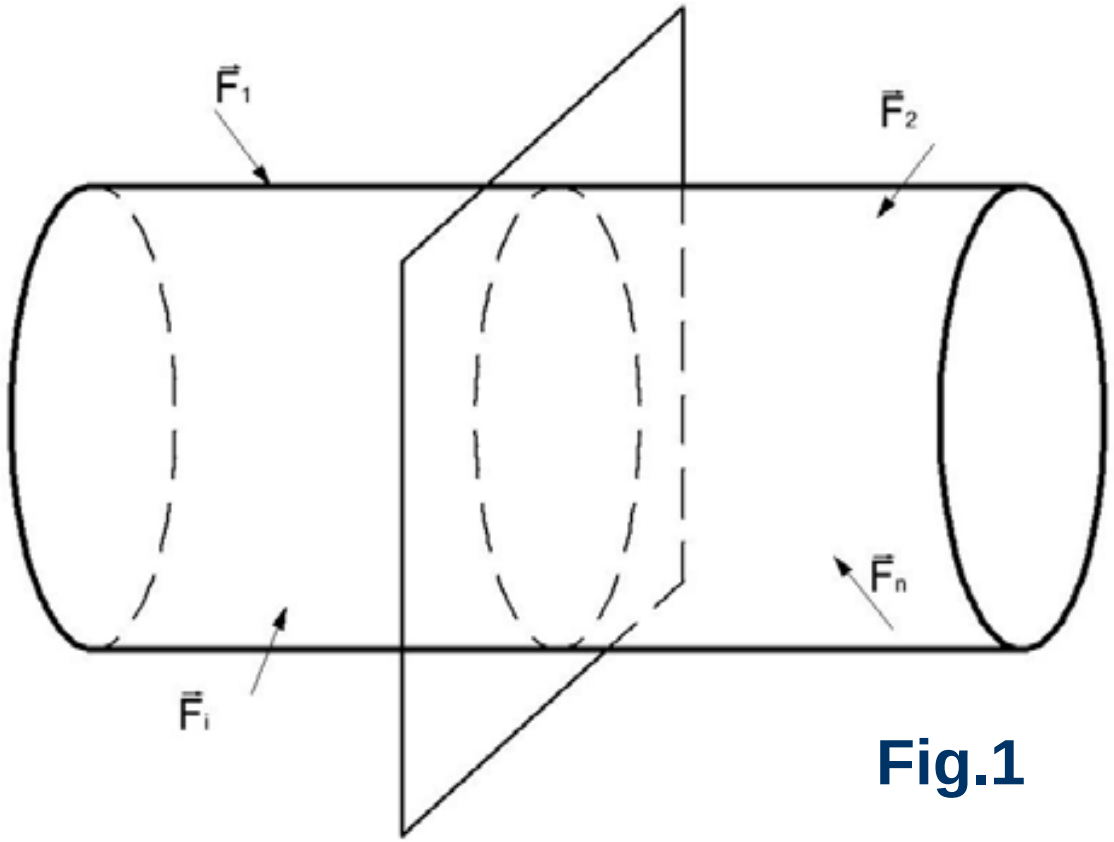
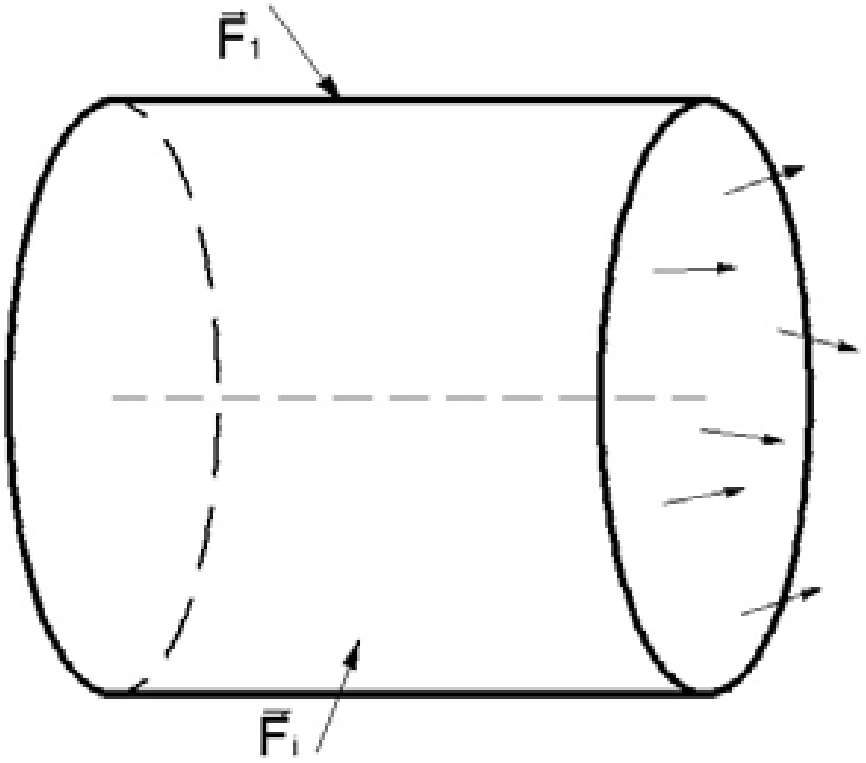


Fig.1

Internal effects of force. Method of section

A body in equilibrium under the action of a set of forces is considered.
This set of forces causes the deformation of the body, where the distances between the body points change.
Then, the forces of interaction between the points also change.
The additional forces of interaction arising in the body are named *internal forces*.

Internal effects of force. Method of section



These additional forces are *the internal forces* in the beam and they give the influence of the right beam part on the left one.

Fig. 2

Internal effects of force. Method of section

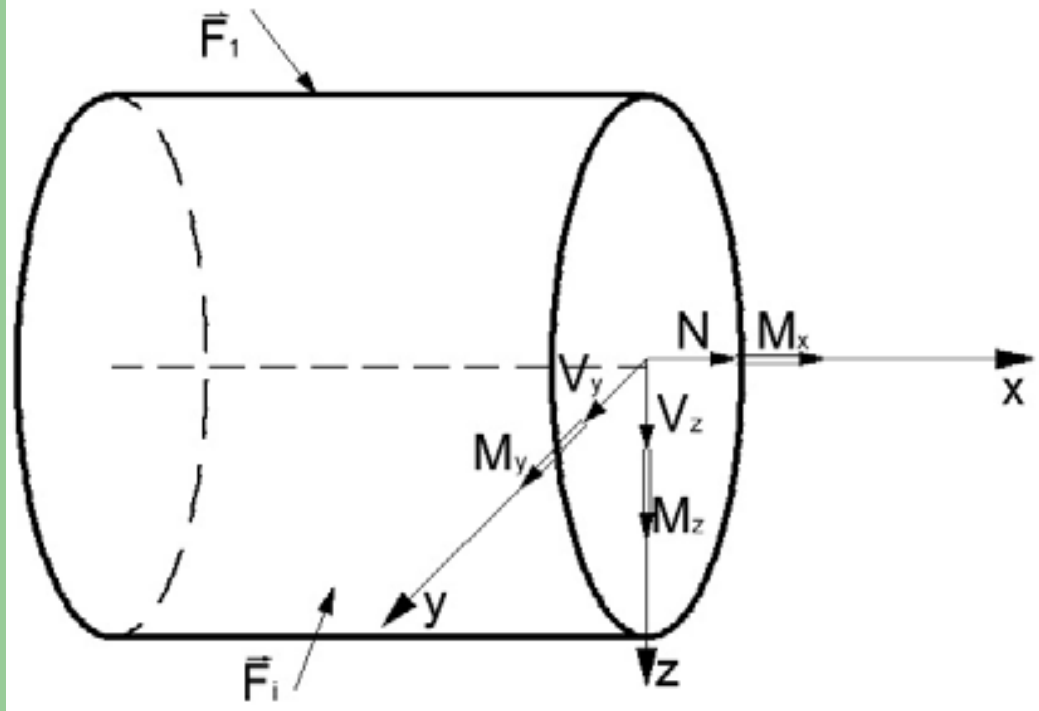
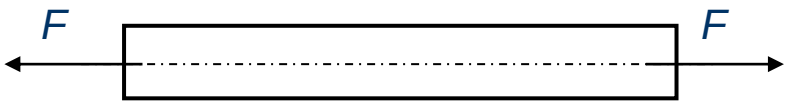


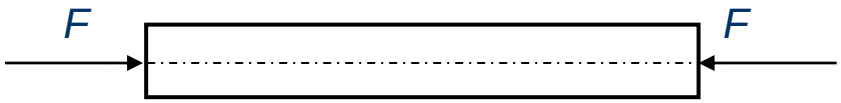
Fig. 3

***N* - axial (normal) force;**
***T* - torsion moment;**
***V* - shearing force;**
***M* - bending moment**

Stresses in the body, which under tension



a



b

Fig. 4

a – tension;
b - compression

$$\varepsilon = \frac{\Delta \ell}{\ell} \quad \textbf{(1)}$$

$\Delta \ell$ - total elongation

ε - the elongation per unit length

Stresses in the body, which under tension

$$\sigma = \frac{N}{A} \qquad (2)$$

σ **- normal stress**

N **- normal force**

A **- area of cross-section**

Mechanical properties of materials by tension

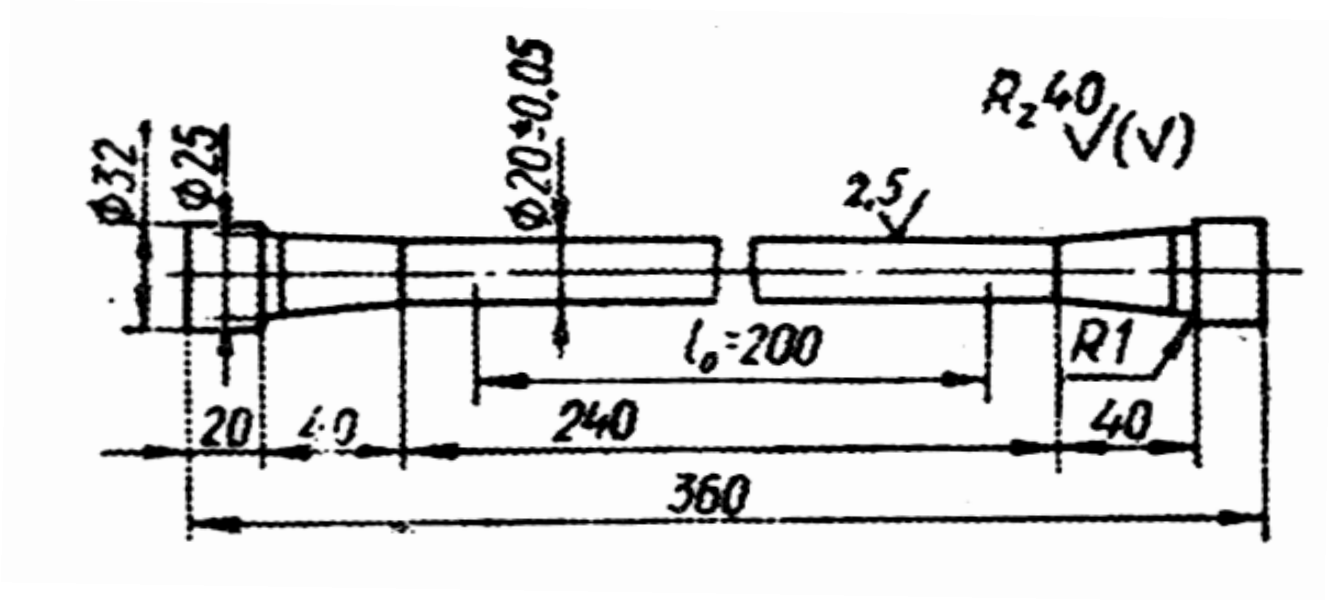
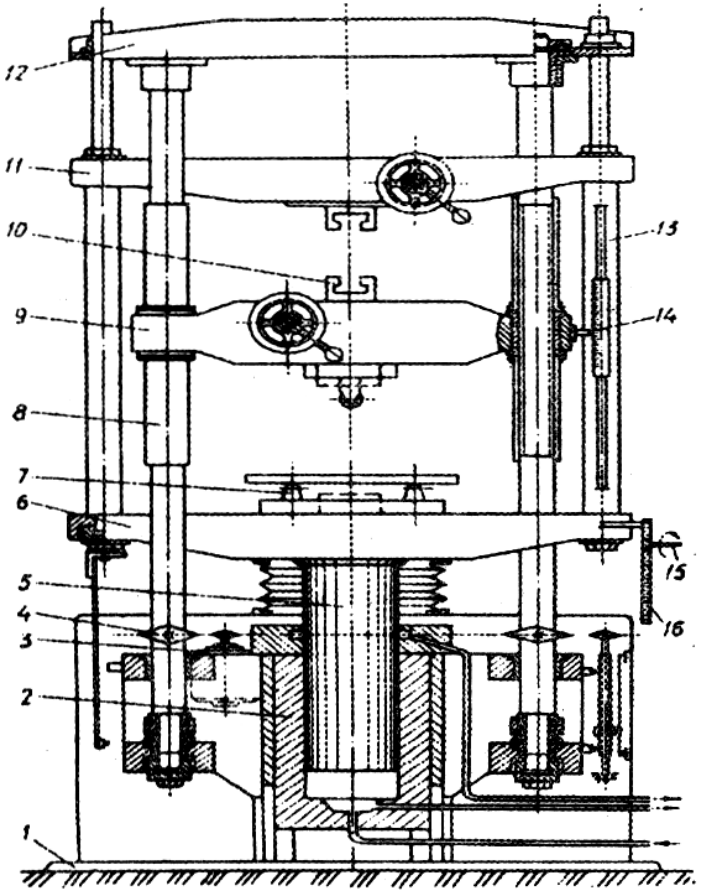


Fig. 5

Mechanical properties of materials by tension



Power part of the test machine

Fig. 6

Mechanical properties of materials by tension

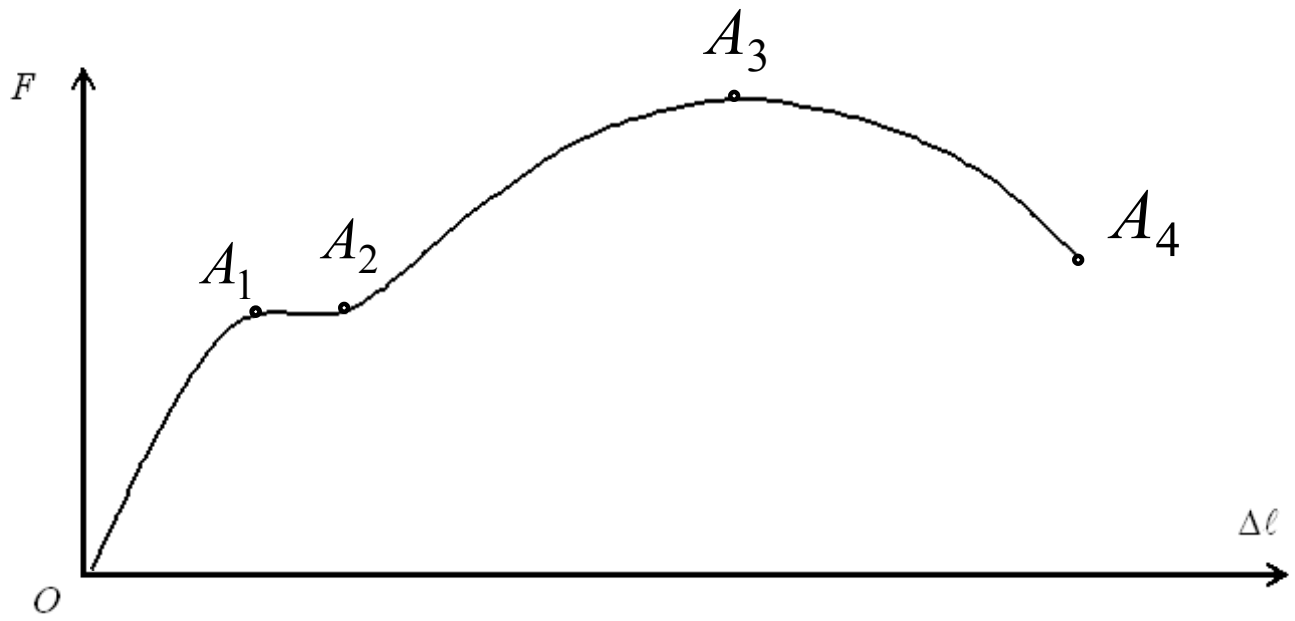


Fig. 7

Mechanical properties of materials by tension

Hooke's law:

$$\sigma = E\varepsilon \qquad (3)$$

Elastik Limit

$$\sigma_{nų} = \frac{F_{nų}}{A} \qquad (4)$$

Mechanical properties of materials by tension

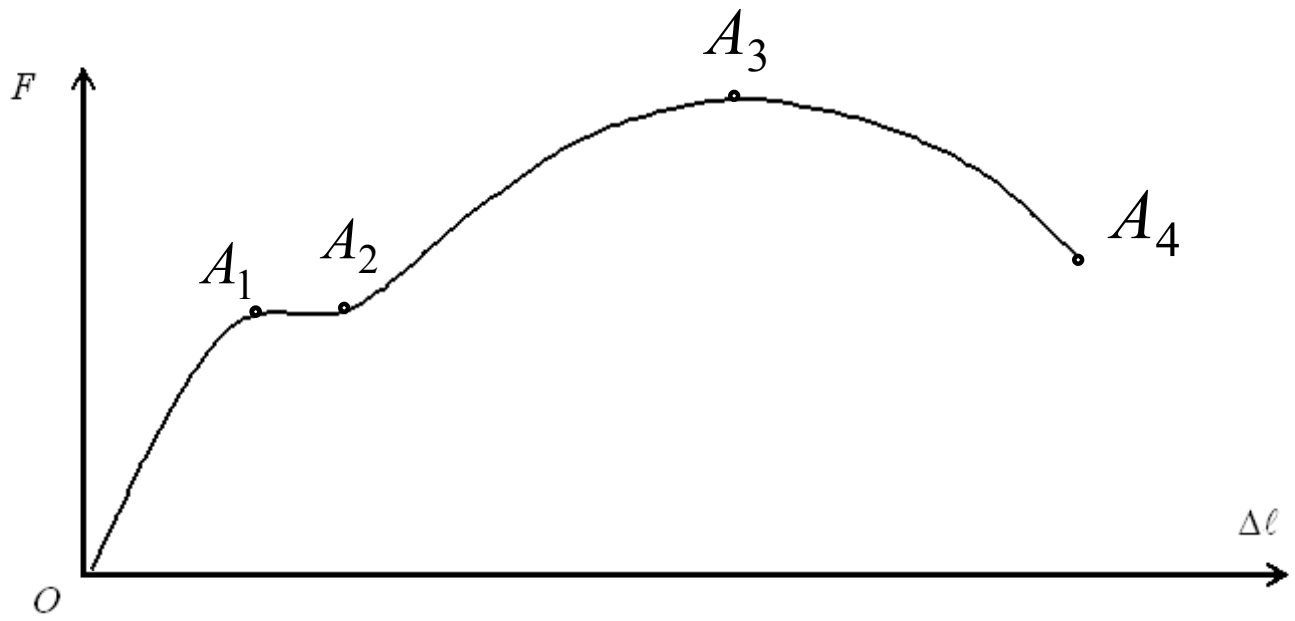


Fig. 7

Mechanical properties of materials by tension

Plastic Limit

$$\sigma_m = \frac{F_m}{A} \qquad (5)$$

Yield Strength

$$\sigma_{мц} = \frac{F_{max}}{A} \qquad (6)$$

Mechanical properties of materials by tension

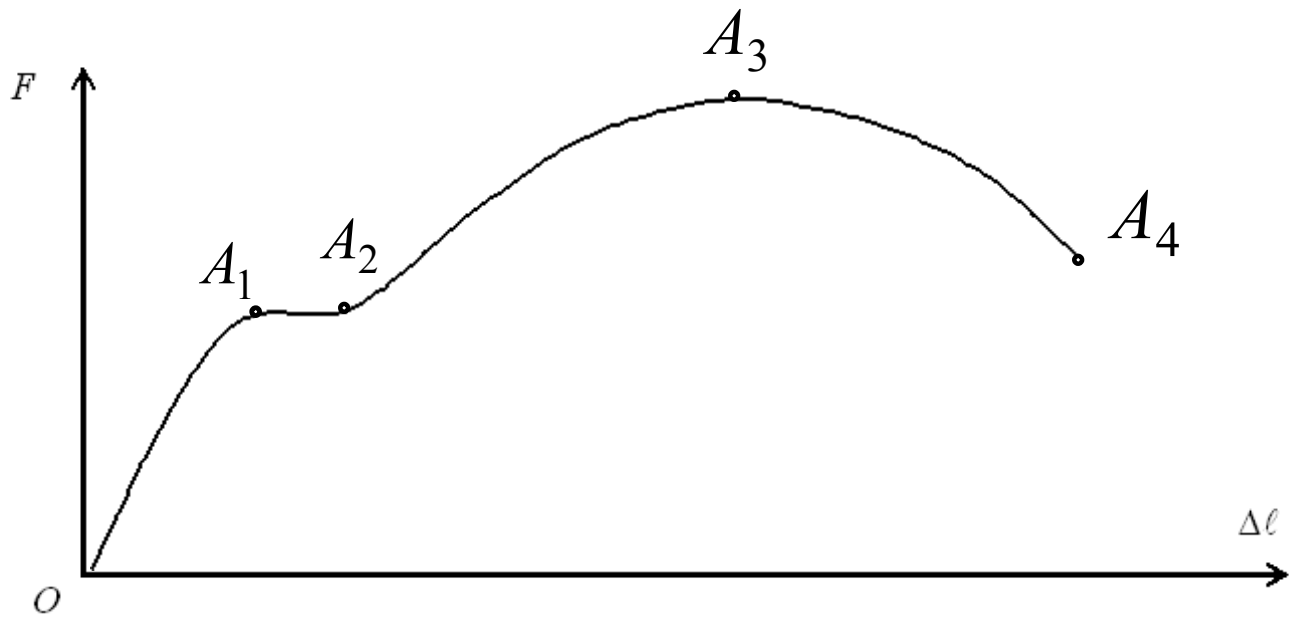


Fig. 7

Thank you!

Good bye!