5th Laboratory exercise

Force synthesis and Force analysis

A. Composition and Force analysis

Theoretical part

On a body acting two or more forces at the same time, at the same point, there is a force that can replace these forces and bring about the same result. This power is called **Resultant** (often denoted by ΣF) and the forces it replaces are called **Components**.

Experimental part

Instruments, apparatus and materials:

1. Two stands
2. Rod
3. 3 links
4. 2 rings
5. 2 Pulleys
6. Masses 50 gr
7. String
8. Protractor
9. Tagged white sheet
10. Paper

Experimental procedure:

1. You will find already assembled the experimental device of Fig. 1. On each base one rod on the top of each one there is a link. A third rod with the two rings bearing hooks are mounted and fastened horizontally. Two rings are hanged from the hooks and a string is passed from both rings.
2. We hang on both string ends equal weights of 1.5 N (150 g). Is the system balancing? explain why.

Figure 1 *Experimental apparatus 1*

3. Add carefully only to the right end one more dumbbell of 0.5 N (50 g). Explain what you are noticing.

4. Hold with your hand the left end so that the system is balanced and hung from the middle of the string five weights of 0.5 N (5x50g) (Fig. 2). Let the system go. Does the system balances? explain why.

Figure 2: *Experimental apparatus 2*

5. Hang the sign with the white sheet of paper and draw on the paper the directions of the forces F_1F_2 And F_3 Dragging lines along the string.

6. Hang up the sign and count the angle F with the protractor. How many squadrons are there? What do you infer about the directions of the forces F_1 And F_2;

7. Use the appropriate scale e.g. 1 cm corresponding to 0.5 N and design on a millimeter paper the vectors of the forces F_1 F_2 And F_3.

8. Make the parallelogram of the forces F_1 And F_2. Bring the diagonal of the rectangle, which is the vector F. Compare it by measure and direction with the power F_3. What do you see?

9. Measure the value of the Resultant force F.

Hint: *Synthesis of forces forming angle 90°*

Suppose at one point the acting two forces F_1 And F_2 Forming Angle 90° (Fig. 3). We ask for the direction and the value of the Resultant force. Constructing the parallelogram of forces the hypotenuse indicates the value of the resultant force. If we apply the Pythagorean theorem, we find its price:

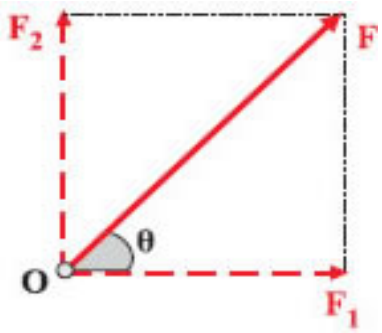

Fig. 3: *Synthesis of forces forming angle 90°*

$$\Sigma F = \sqrt{F_1^2 + F_2^2}$$

The angle I Determined by the relationship:

$$\varepsilon\varphi\theta = \frac{F_2}{F_1}$$