6th Laboratory exercise

Force Torque

Theoretical part

When we exert Force on a solid body through which an axis passes, usually the body revolves around that axis. The ability of a force to rotate a body around an axis is described quantitatively by the physical size that we call Torque. The value of torque M of a force referred to the axis of rotation is defined as the product of the value of force F and the vertical distance d of the Force from the pivot axis:

$$M=F\times d$$

Torque Unit in Si is 1 $N\,m$.

A solid body or a lever balances when the sum of the M_1 of the moment as to the pivot axis to the left is equal to the sum of the M_2 of the moment to the right:

$$M_1=M_2 \qquad or \qquad F_1 d_1 = F_2 d_2$$

If the torques are not equal, the lever is directed at the direction of the bigest torque.

Experimental part

instruments, apparatus and materials:

1. Rod mounted on a base
2. Rod
3. 2 simple Links
4. Aluminum lever
5. Hangers
6. Masses 50 gr and 100 gr
7. String
8. Ruler

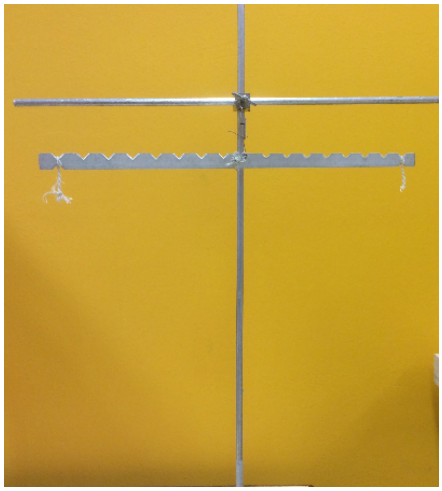

***Fig.** 7: Experimental layout*

Experimental procedure:

A. Force torque as to an axis rotation

1. You will see an assembled stator and at the top of the rod fastened a simple ligament. From the edge of the ligament an aluminum lever hanged.
2. Place at both ends of the lever similar hangers. What do you notice?
3. Transfer a hanger from the edge to the middle of the lever. What do you notice? Justify your answer.

4. Hang ta dumbbell 0.5 N (50 g) on a hanger. Measure the rider's distance from the axis of rotation and write it down.
5. Calculate torque M_1 of the weight as to the axis of rotation (pivot axis).

B. Lever balance

1. Hung on the left rider of the weight lever F_1= 0.5 N (50 g) and on the right weights of total weight F_2= 1 N (100 g). Move the hanger appropriately so that the lever balances horizontally.

1. Measure with the ruler the distances d_1 and d_2 of the Forces F_1 and F_2 from the pivot axis and calculate their torque M_1 and M_2 Respectively.

1. examined whether the torques M_1 and M_2 are equal or otherwise if their numerical sum is zero: $M_{Ol}= F_1 d_1 - F_2 d_2 = 0$.

1. Fill in the Table 1.

    1. Repeat procedures 1, 2, 3 and 4 once again hanging on the left hander a weight of F_1= 1.5 N (150 g) and on the right hanger a weight of F_2= 2 N (200 g). Note the results in Table 1.

    2. Repeat for third time procedures 1, 2, 3, and 4 hanging on the left hanger a weight of F_1= 0.5 N (50 g) and on the right one a random link. Calculate the weight of the link. What are you now using this experimental device for?

    3. The above procedures verify the lever balance Torque and force balance (moment theorem); Articulate them in your own words.

Table 1

F_1(N)	d_1(cm)	F_2(N)	d_2(cm)	M_1(N cm)	M_2(N cm)	$M_{o\lambda}$