NOVATEUR PUBLICATIONS
INTERNATIONAL JOURNAL OF INNOVATIONS IN ENGINEERING RESEARCH AND TECHNOLOGY
[IJIERT] ISSN: 2394-3696 Website: ijiert.org
VOLUME 8, ISSUE 6, June. -2021

SOLVING THE PROBLEMS OF THE SUSTAINABILITY OF SYSTEM OF CROSSING FORCES IN THE PLANE IN SEVERAL WAYS

Eshbayeva Zoxida
Assistant of the Department of "Mining Electrical Mechanics" NDKI

ABSTARCT

The article contains problems on the topic “ Solving the problem in several ways concerning the equilibrium condition of convergentsystem of forces located in the plane”. The problem and solutionare silved in an anaiytical and geometric way relating to a system of convergent forces. The problemis solved in two ways.

Keywords: system of reconverginging power, condition of the balance, geometric way, analytical way, projection of power, power to gravity, power of the effort, power triangle.

INTRODUCTION

Today, we need to train future personnel to be fully mature, full-fledged and able to think deeply, to think independently, to apply new innovative ideas.

That is, it is one of the main factors for the independent solution of various problems and innovations encountered in the process of scientific and technological development. To do this, bachelors will have real knowledge only if they know the theorems and laws of the basic theoretical concepts of science and apply them to the problems of academic science.

Therefore, in this article we will consider the subject of "Theoretical Mechanics" "Solving problems on the equilibrium of a system of intersecting forces in a plane in several ways."

This leads to an understanding of the theoretical concepts in the process of studying the theoretical concepts of the subject, and then, of course, in solving several problems on this topic, and is reflected in the process of considering the objective laws of physics.

Equilibrium of a system of forces meeting at one point

A system of forces whose lines of action intersect at a point is called a system of forces. A system of forces meeting at a point has an effect equal to the principal vector, which is the geometric sum of the forces applied to that point.

In order for a system of forces meeting at one point to be in equilibrium, the principal vector of these forces must be zero

$$\vec{R} = \vec{F}_1 + \vec{F}_2 + ... + \vec{F}_n = \sum_{k=1}^{n} \vec{F}_k = O$$

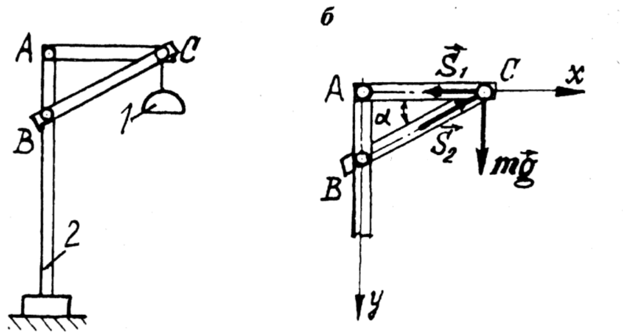
The geometric condition of equilibrium of the system under consideration is characterized by the fact that the system is closed by a polygon constructed by force vectors. Through the projections on the rectangular coordinate axes: $\Sigma F_{kx} = \Sigma \ \mathrm{x}_{\mathrm{k}} = 0$; $\Sigma \mathrm{F}_{\mathrm{ky}} = \Sigma Y_k = 0$; $\Sigma \vec{\mathrm{F}}_{\mathrm{kz}} = \Sigma Z_k = 0$

For a system of plane forces where the line of action of all the forces that make up the system meets at a point lying in the same plane:

$$\Sigma F_{kx} = \Sigma \ \mathrm{x}_{\mathrm{k}} = 0; \quad \Sigma \mathrm{F}_{\mathrm{ky}} = \Sigma Y_k = 0;$$

Problem: The lamp of the quarry lighting device (1) is mounted on the movable column (2) using the AC horizontal and BC inclined pole (Fig. 1. a). If the mass of the lamp is m = 53.7 kg; If lAS = 0.85 m, lVS = 1.0 m, and nodes A, B, and C are hinged, determine the stresses on the AC and BC rods.

STRUCTURE



Solution. We replace the rods holding the node C with the corresponding voltage and the mass of the lamp by its gravitational force. (Fig. 1. b). In this case, if we look at the equilibrium of node C, all the forces acting on the node are located in the same plane and intersect at a single point C.

The first method. Analytical method. If we place the coordinate head at point A and orient the coordinates as in Figure 1.b, we use the equilibrium equation for the system of intersecting forces. $\vec{R} = 0$

As a result of projection on the X and Y axes from the equilibrium condition in the form of a vector we write:

$$\sum X_{\kappa} = 0 \qquad \sum Y_{\kappa} = 0$$

$$\sum X_{\kappa} = -S_1 + S_2 \cdot \cos\alpha = 0$$
$$\sum Y_k = mg - S_2 \cdot \sin\alpha$$

ABC triangle $\cos\alpha = \frac{l_{AC}}{l_{BC}} = 0{,}85$

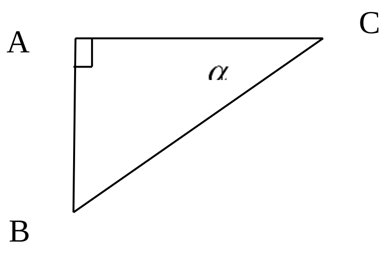
It turns out that From this $\sin\alpha = \sqrt{1-\cos^2\alpha} = \sqrt{1-0{,}85^2} = 0{,}5268$

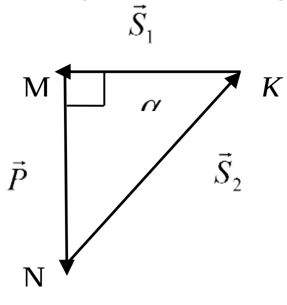
$$S_2 = \frac{mg}{\sin\alpha} \approx 1000\ H \qquad S_1 = S_2 \cos\alpha = 850 H$$

$S_1 = 850 H; \quad S_2 \approx 1000\ H$

Second method: Geometric method. According to this method $\vec{P},\ \vec{S}_1, \vec{S}_2$ the power triangle built on the forces must be closed. At any point M on a scale to draw a power triangle $\vec{P}$ We transfer the force parallel to it. $\vec{P}$ Draw lines parallel to the points AC and BC from the points M at the beginning and T at the end of the force and mark their point of intersection with K.

MNK represents the power triangle sought. In this case, KM and NK represent the reaction force, ie the stresses, respectively. Measure the sides KM and NK of the triangle MNK on a given scale , $\vec{S}_1$ and $\vec{S}_2$ we determine the modulus of stresses.





$\vec{S}_1$ and $\vec{S}_2$ we use the sine theorem to determine

$$\frac{P}{Sin\alpha}=\frac{S_1}{Sin(\frac{\pi}{2}-\alpha)}=\frac{S_2}{Sin\frac{\pi}{2}}$$

$$\frac{P}{Sin\alpha}=\frac{S_1}{Cos\alpha}=\frac{S_2}{Sin\frac{\pi}{2}}$$

$$\cos\alpha=\frac{l_{AC}}{l_{BC}}=0{,}85$$

$$\sin\alpha=\sqrt{1-\cos^2\alpha}=\sqrt{1-0{,}85^2}=0{,}5268$$ and P=mg=526,26N

By setting values, $\vec{S}_1$ and $\vec{S}_2$ we determine

$$\frac{526{,}26}{0{,}5268}=\frac{S_1}{0{,}85}=\frac{S_2}{1}$$ **: answer** $S_1=850H;\quad S_2\approx1000\ H$

This problem can also be determined by the similarity property of the triangle.
That is, the corresponding sides of the power triangle MNK can be determined from the ratio of the numerical values of the second triangle ABC.
To do this, we determine the numerical value of the sides of the triangle ABC.

Given: l_{AC}=0,85 m, l_{BC}=1,0 m $l_{AB}=\sqrt{1-(0.85)^2}=0.5267m$

$$\frac{P}{AB}=\frac{S_1}{AC}=\frac{S_2}{BC}$$

$$\frac{526{,}26}{0{,}5267}=\frac{S_1}{0{,}85}=\frac{S_2}{1}$$

we find from here**:** $S_1=850H;\quad S_2\approx1000\ H$

In conclusion, it can be said that when solving a problem in several ways, rather than solving several problems in one way, the student understands the essence of the basic concepts of the laws, theorems of "Theoretical Mechanics". Gains experience in applying the acquired theoretical knowledge in practice. At the same time, the knowledge of theoretical concepts of analytical equilibrium conditions and geometric equilibrium conditions on this topic is considered to be mastered in practice.

REFERENCES

1. Mirsaidov M.M. Baymurodova L.I. Giyasova NT "Theoretical Mechanics", a textbook for universities. Tashkent, Uzbekistan. 2008.
2. Meshcherskiy I.V. Collection of Problems in Theoretical Mechanics, Tashkent, Teacher, 1990.