THE FUNDAMENTAL THEOREM OF STATICS AND THE EQUILIBRIUM CONDITION OF THE SYSTEM OF SPATIAL FORCES

Xolbekov Toshturdi Qudratovich[1]
[1]Teacher of the Department of Storage, Processing and Mechanization of Agricultural Products, Termiz Institute of Agrotechnologies and Innovative Development
Choriyev Aliqul Jumayevich[2]
[2]Teacher of the Department of Storage, Processing and Mechanization of Agricultural Products, Termiz Institute of Agrotechnologies and Innovative Development
https://doi.org/10.5281/zenodo.7445191

Annotation: This article describes the basic theorem of statics and the equilibrium condition of the system of spatial forces about the laws of statics.
Key words: statics, basic theorem of statics, spatial forces, balance condition.

Movement is one of the forms of existence of matter and represents its most important characteristic feature.

The movement of matter refers to complex processes that take place in thermal, chemical, electromagnetic, biological and other changes, starting from the simple movement of bodies.

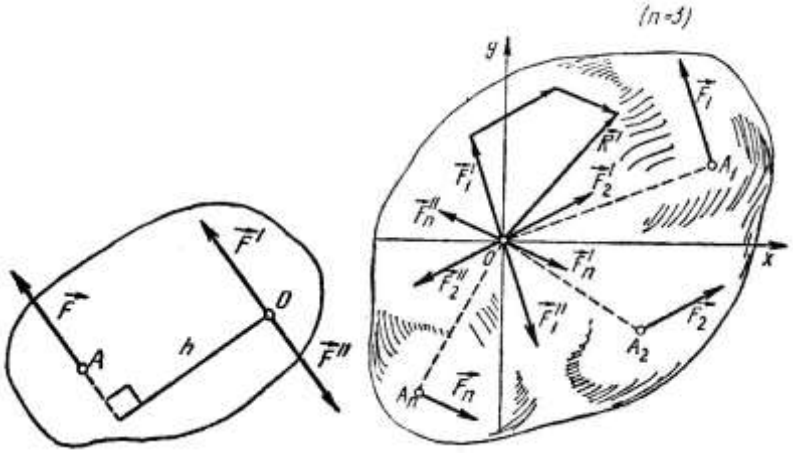
One of the simple types of motion is mechanical motion. Movement of material bodies relative to each other over time is called mechanical motion.

Theoretical mechanics is the science of the interaction of material bodies and the general laws of mechanical motion.

In mechanics, the quantitative measure of the interaction of material bodies is called force.

The theoretical mechanics course is divided into three parts: statics, kinematics and dynamics. Statics deals with issues such as the balance of bodies and the simplification of forces applied to them.

If the forces acting on the body lie in the same plane, it is called a system of forces in the plane.



Lemma: A force applied to a point of a body is equivalent to a similar force applied to an arbitrary center of reference taken on the body and its moment equal to the moment of the given force relative to the center of reference.

Let's say that an arbitrary system of forces $F_1, F_2,...,F_n$ is imposed on a rigid body. In that case, the following rates are appropriate.

1. The geometric sum of the system of forces $F_1,F_2,...,F_n$ applied to the body is called the principal vector of the given forces,

$$F = F_1 + F_2 +...+ F_n = \sum F_k$$

k=1

2. 2. The geometric sum of the moments obtained from the forces applied to the body relative to a center is called the principal moment of the given forces, that is:

$$M_0 = m_0(F_1) + m_0(F_2) +...+ m_0(F_n) = \sum_{k=1}^{n} m_0(F_k)$$

Now, using the lemma seen in the previous paragraph, we will prove the following theorem. Poinsot's theorem. Bringing a system of forces located arbitrarily in space to a center $A_1, A_2,..., A_n$ results in one force equal to the principal vector F placed at the center $F_1, F_2,...., F_n$ moment is equivalent to one pair of forces equal to M0. Proof. Let the forces $F_1, F_2,...., Fn$ be applied to the points $A_1, A_2,..., An$ of the body. We apply Poinceau's lemma to each of these forces, that is, we move these forces parallel to the center of gravity O (Fig. 1.39). The result is given at point O

forces $F_1', F_2',...,F_n'$ equal to forces and (F_1,F_1), (F_2,F_2''),..., (Fn,Fn'') pair of forces is the product".

It is known that is placed at point O. The forces F1′, F2′,..., Fn′ can always be replaced by one equal force, i.e. R = F1′+ F2′+,..., + Fn′

If we consider that F1 = F1′ , F2 = F2′,..., Fn = Fn′, based on equality

$$F = F1 + F2+,.. .,+Fn$$

If we compare equations (1.7) and (1.10), their right sides are equal to each other, and the left sides are equal to the geometric sum of forces exerted on one point and on different points of the body. denotes the prime vector. In other words, for transverse forces, the principal vector is equal to the main vector and has the same meaning. But it will not always be possible to determine a single equal effector for arbitrary forces applied to different points.

$(F1,F1'')$, $(F2,F2'')$,...,(Fn,Fn'') pairs of moments placed at the center of rotation O correspondingly M1 , M2,..., Mn, based on equality

$$M_O = M1 + M2 + ...,+Mn \text{ or } M_O = m_O(F1) + m_O(F2) +...+ m_O(Fn) = \sum_{k=1}^{n} m_O(Fk) .$$

Compared to this equation, it gives the principal moment of the given forces.

So,

$(F1,F2,..., Fn) \sim (F1',F2',..., Fn'; (F1,F1'p'), (F2,F2''),..., (Fn, Fn''))\sim$

$\sim (R, M1, M2,..., Mn) \sim (F, MO)$,

that is, the theorem is proved.

Thus, the system of forces (F1, F2,..., Fn) placed on a rigid body is equivalent to one principal vector and principal moment placed on an arbitrary reference center, i.e.:

$$(F1, F2,..., Fn) \sim (F , MO),$$

It should be remembered that the concept of the main vector and the main moment is not only necessary to make the formulas look simple, but also to simplify the calculation of the forces placed on the body. For example, if we observe the movement of a shaft mounted on a bearing, during the rotation of the shaft, the points lying on its surface are affected by frictional forces of the bearing. The number of points on the shaft surface and the modulus of frictional forces are unknown. It is not always possible to determine the values of these forces

through experiments. But it will be possible to easily measure the main moment of the sum of moments relative to the axis of rotation of the frictional forces. The main characteristic of a similar electric motor is not the power, but the torque of the stator acting on the rotor.

References:

1.Yaxyoyev M.S., Mo'minov B. "Nazariy mexanika". Toshkent,"O'qituvchi", 1990.
2.Butenin N.V., Luns Ya.L., Merkin D.R.. Kurs teoreticheskoy mexaniki, 4-ye izd., pererab. i dop. -M., Nauka, 1985. tom.1,2
3.Bat M.I., Djanelidze G.Yu., Kelzon A.S. "Teoreticheskaya mexanika v primerax i zadachax". 9-ye izd. dop., M., Nauka, 1990, t.1,2.
4.Aziz-Qoriyev S.K., Yangurazov Sh.X. "Nazariy mexanikadan masalalar yechish metodikasi" (Statika va kinematika). Qayta ishlangan 2-nashri. -Toshkent, "O'qituvchi", 1974.
5.Yablonskiy A.A., Noreyko S.S., Volfson S.A. Sbornik zadaniy dlya kursovix rabot po teoreticheskoy mexanike. 3-ye izd. ispr., M., Visshaya shkola, 1978.
6.Xusanov Q. «Qattiq jismning qo'zg'almas o'q atrofidagi harakati» mavzusi bo'yicha hisobgrafik ishlarini o'rganish uchun metodik ko'rsatma/ - 1993.
7.Saytlar: http://www.uni.udm.ru/pubhouse/shop2.htm - 509,574 bayt
http://www.pedagog.uz/libr/index.php?showid=690&PHPSESSID
=a3e6763eee24f2029b37d6b42f2883d8
http://elkutubhona.narod.ru/html/el_mar_qurilish.htm - 5,804 bayt