Generalized law of mechanics

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Abstract

In the article is examined the united law of mechanics, which generalizes three Newton's law. It is shown that in whatever state was the object: at rest, or of uniform or of accelerated motion the vector sum of the forces acting on it is zero

It is known three Newton's law, which are formulated as follows:

It says the first law in the contemporary formulation:

There exist reference system, called inertial with respect to which the material point when they no force (or forces are mutually balanced), are in a state of rest or rectilinear motion.

The second law in the contemporary formulation is formulated as follows:

In the reference system the acceleration, which obtains the material point with a constant mass, directly proportionally resulting all applied to it forces and is inversely proportional to its mass.

The third law is formulated as follows.

Material points interact with each other by the forces, which have identical nature, directed along the straight line, which connects these points, equal on the module and opposite in the direction:

We know that the forces by their nature can be potential and kinetic. Potential forces are determined by the gradient of the scalar potential, in field of which is located the object. The gravitational forces, which follow from the law of universal gravitation, are an example of such forces

$$F = G\frac{mM}{r^2}.$$

To the object m from the side of the object M acts the force

$$\vec{F} = mG\ grad\frac{M}{r}.$$

Is correct the reverse assertion

$$\vec{F} = MG\ grad\frac{m}{r}.$$

To the same law are subordinated the forces of interaction of the electrified bodies, which are determined by Coulomb law

$$F = K\frac{qQ}{r^2}.$$

To the charge q from the side of the charge Q acts the force

$$\vec{F} = qK\ grad\frac{Q}{r}.$$

Is correct the reverse assertion

$$\vec{F} = QK\ grad\frac{q}{r}.$$

Besides potential forces there are kinetic (inertial) forces, which are connected with the fact that object they have a mass, also, in order to accelerate such bodies to them necessary to exert force.

$$\vec{F} = m\vec{a}.$$

This force can be as the contact nature, when on the object indicated acts another object, so also the potential nature, when body is located in the field of the scalar potential of another object Let us examine several interaction types and motion of material object.

If no forces act on the object, then it rests or it moves in the assigned inertial system with the constant velocity and the summary vector of the forces, which act on this body is equal to zero. If on the body act potential forces, and it rests in the assigned inertial system, then means there is the support, which balances potential forces. In this case the summary vector of the forces, which act on the object, is also equal to zero.

If on the object contact force, and the object does not have the support or other connections with the inertial reference system, then object accomplishes increasing motion. In this case contact force is also balanced by the inertial force and the summary force vector is equal to zero. If free object is located in the potential field forces, then one of the relationships is carried out: For the gravitational forces taking into account the direction of the force vectors it takes the form

$$m\vec{a} + mG\ grad\frac{M}{r} = 0$$

I.e. the vector sum of the forces, which act on the object is equal to zero.

For the electric forces we have the analogous relationship:

$$m\vec{a} + qK\ grad\frac{Q}{r} = 0$$

And the again vector sum of forces is equal to zero.

Thus, all three Newton's law can be combined into one generalized law with the following formulation:

In whatever state was the object: at rest, or of uniform or of accelerate motion the vector sum of the forces acting on it is zero