The Relativistic Interaction of the Temporary States of the Moving Body

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Abstract: *The possibility of extending the formula for the inertia force to the region of relativistic velocities is studied. It isshown that the introduction of a correction function describing the possible changes in mass at speeds commensurate with the speed of light leads to unreal results. The change the form for the force of inertia is associated with a relativistic reduction in the time interval, which corresponds to modern ideas about this process.*

Keywords: *inertia force, relativistic approximation*

1. INTRODUCTION

Since Newton's time, force is a measure of the interaction of bodies and the reason why the body gets accelerate. However, the force of inertia, calculated as the product of mass per acceleration, does not imply any interaction and Newton's third law is unfair to it. The unification of the various definitions for one object is a sure sign of the imperfection of the model. According to modern ideas, time is recognized as the fourth coordinate in the Minkowski space. However, almost nothing is known about the form of existence of any objects in time. In [1] it is proposed to describe the force of inertia,as a result of the action of the past and future state of a moving body on its motion at each moment of time. The validity of the proposed method is based on the results of a recent real Wheeler experiment [2-5], in which the influence of the future state of the particle on its motion is recorded. The method proposed in [1] is followed on the principle of symmetry of temporary states of the body. It satisfies Newton's first law-the body, free from interactions, moves uniformly and rectilinearly. It follows that the violation of time symmetry in the movement of the body is a sign of the force. Naturally, in the case of the interaction of the temporary states of a moving body, the magnitude of the force decreases with increasing time interval between these states. Based on the formula of the inertia force, it was assumed that the characteristic of the interaction is a value equal to the square root of the power pulse on impulse of force. Only the non-relativistic approximation was considered.

For uniformly accelerated rectilinear motion and a relatively small speed increment (Fig.1) it is easy to derive the classical expression for the force of inertia as the resultant of the two forces of interaction.

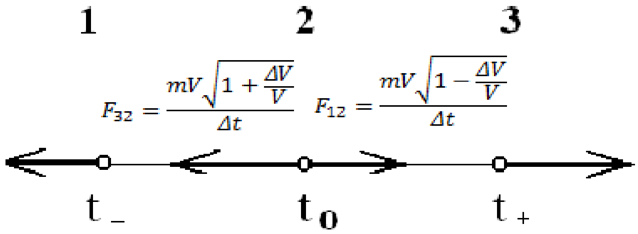
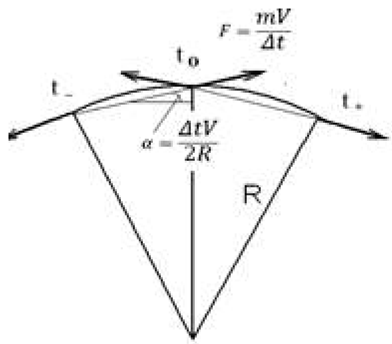


Figure 1. *Rectilinear uniformly accelerated motion.*

As follows from further analysis, the interaction of time states occurs on the Planck time scale. As a result, the speed increment for real movement is always much less than the magnitude of the speed. Of particular interest is the moment of the beginning and end of the movement, since the momentum of the body at this moment is zero, and therefore the force of the time interaction is also zero. This case will be considered in the following publications.

To derive the value of the inertia force when the body moves along a circle, the proposed scheme is shown in figure 2



As can be seen from Fig. 2, for a body moving in a circle at small values of the angle α, the centrifugal force also corresponds to the classical expression.

Important advantages of the proposed method are:

- a single form of the description of the interaction forces,

- observance of the third law of Newton - equality of forces of action and reaction.

In this paper, we study the form of the temporal interaction formula applicable for relativistic velocities.

2. RELATIVISTIC EXTENSION OF THE FORMULA FOR CALCULATING THE INERTIA FORCE.

To expand the range of applicability of the method of calculating the inertia force, suppose that a body of mass m increases its velocity V by an amount ΔV in the time interval Δt

$$F = \frac{\sqrt{mV}\,y(V)\sqrt{m(V+\Delta V)}\,y(V+\Delta V) - \sqrt{mV}\,y(V)\sqrt{m(V-\Delta V)}\,y(V-\Delta V)}{\Delta t} \quad (1)$$

For the transition to the relativistic case, the function of the temporary state was multiplied by the dimensionless correction coefficient, y (V).

In the transition to dimensionless units, we arrive at the equation

$$\frac{dy(x)}{dx} = \frac{1}{2y(x)}\left(\frac{1}{\sqrt{1-x^2 y(x)}} - y(x)\right) \quad (2)$$

where x is the speed normalized to the speed of light, and y (x) is a correction factor depending on x.

Figure 3 shows the calculated value of the correction factor obtained by digital integration of equation (2).

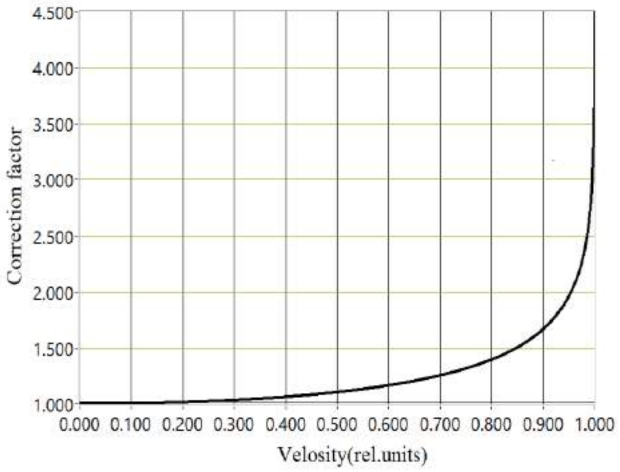


Figure 3. *The calculated value of the correction factor of the relative velocity*

An attempt to represent the function y (x) in the form of a power series, logarithmic or exponential functions led to a result whose complexity clearly contradicted the original goal of obtaining a simple correction function suitable for an already solved problem.

The obvious solution to this problem consists in relativistic shortening of the time interval in a coordinate system moving at speed V. In this case, the expression for the inertia force takes the form

$$F = \frac{\sqrt{mV}\sqrt{m(V+\Delta V)} - \sqrt{mV}\sqrt{m(V-\Delta V)}}{\Delta t\sqrt{1-(\frac{V}{C})^2}}$$

The adopted form of the formula for the inertia force serves as confirmation of the modern concepts, according to which the mass of a body moving at a relativistic speed does not change its magnitude.

You must specify the main features of the proposed model:

- the dependence of the instantaneous value of force, both on the past and on the future temporary state,
- the formula for the inertial force in its form is the coefficient of time asymmetry of the trajectory of the body, coinciding in form with the known forces of interaction.
- the formula that determines the magnitude of the force of inertia, for the relativistic case, indicates the unchanged mass in the entire range of speeds.

The condition of the relative smallness of the velocity increment deserves special consideration. It can be assumed that the temporal interaction occurs on the Planck time scale. In this case, in any practical movement, the increment of speed will be negligible compared with the instantaneous magnitude of speed.

Of interest is the Planck's square root of the impulse, which determines the value of the inertia force. The Planck mass is 2.1 10^{-8} kg, and the speed of light is 2.99 10^{8} m / s. Consequently, the rate of temporary interaction is 2.5 (kg m / s) $^{0.5}$.The value of the index indicates that quantum effects should be manifested in the time (inertial) interaction of real bodies. The accepted form of interaction is similar to the wave function in quantum mechanics, the square of which determines the probability of occurrence of a particle at a certain point in space and time.

The primitiveness of the mathematical apparatus of the article is fully compensated by the exotic nature of the representation of inertial forces. Before the results of the actual Wheeler experiment, such assumptions could have been rejected as absurd. But at the present time, at least, they can compete with the classical description of the force of inertia.

3. CONCLUSIONS

Based on the interpretation of the results of the actual Wheeler experiment, a new formula for inertia force is proposed, which is valid in the relativistic field.

The movement of the physical body can be represented as the result of the interaction of its temporary state with the future and past states.

In fact, practically nothing is known about the form of existence (interaction) of any objects in time. The proposed scheme is the first attempt to analyze in this area.

The formula in the nonrelativistic case gives a canonical expression of inertial force for uniformly accelerated body motion and body motion in a circle. The adopted ideology makes it possible to describe the force of inertia as a kind of interaction for which Newton's third law applies. At present, it is impossible to determine the type of particles involved in the interaction described above. The truth of the presented method can be solved only by a model physical experiment.

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