Journal of Applied Mathematics and Computation, 2022, 6(3), 282-289
https://www.hillpublisher.com/journals/JAMC/
ISSN Online: 2576-0653
ISSN Print: 2576-0645

Two Postulates of Special Relativity—Relativity Principle and Invariance Principle of Light Speed

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How to cite this paper: Haijun Liu. (2022) Two Postulates of Special Relativity—Relativity Principle and Invariance Principle of Light Speed. *Journal of Applied Mathematics and Computation*, 6(3), 282-289.
DOI: 10.26855/jamc.2022.09.002

Received: May 27, 2022
Accepted: June 22, 2022
Published: July 14, 2022

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Abstract

With the two hypotheses of special relativity, the principle of relativity and the principle of invariance of the speed of light, as the main line, according to Einstein's statement of "the length of the bar in the static system" and "the length of the bar in the dynamic system", the concept of "the length of the distance between two points in the static system" and "the length of the distance between two points in the dynamic system" is introduced. It is pointed out that "the length of the distance between two points in the dynamic system" is a little longer than "the length of the distance between two points in the static system", and "the length of the distance between two points in the static system" is a little shorter than "the length of the distance between two points in the dynamic system". The relation between the length of the distance between two points in a dynamic system and the contraction factor (σ) = the length of the distance between two points in a static system. Then the concepts of "the time between two points in static system" and "the time between two points in dynamic system" are put forward. As in the case of length, the time between two points in a moving frame is a little longer than the time between two points in a stationary frame, and the time between two points in a stationary frame is a little shorter than the time between two points in a moving frame. Furthermore, it is deduced that the Lorentz transformation is not valid. It is pointed out that the forward and contravariant lorentz transformations must be corresponding line segments in the dynamic and static systems between two points. The result is inconsistent with the Lorentz transformation, so the relativity principle of special relativity is not valid. It is pointed out that motion does not cause any change in the length and time of spacetime. Galilean transformation of Newtonian mechanics is correct, and Lorentz transformation of special relativity is wrong. All kinds of errors in the derivation of γ coefficient in special relativity are pointed out. It points out various errors in the formula of lorentz velocity transformation in special relativity. The final formula of lorentz transformation of special relativity and its forward and inverse transformation are presented.

Keywords

The principle of relativity, The principle of invariance of the speed of light, The length of the distance between two points in the static system, The length of the distance between two points in the dynamic system, The time between two points in static system, the time between two points in dynamic system

1. Introduction

Special relativity is based on two assumptions: the principle of relativity and the principle of invariance of the speed of light.

The principle of constant speed of light states that the speed of light in vacuum has a constant value in all inertial systems, and has nothing to do with the implicated speed of moving inertial systems.

In accordance with the principle of the invariable speed of light, the space-time coordinate relations between the dynamic system and the static system are called the forward transformation of lorentz transformation, they are

$$x' = \gamma(x - vt)$$

$$t' = \gamma\left(t - \frac{v}{c^2} \cdot x\right)$$

$$y' = y$$

$$z' = z$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

The principle of relativity says that all the laws of physics have the same expression in all inertial systems.

In this way, the original static system is regarded as a dynamic system, the original dynamic system is regarded as a static system, the space-time coordinate relation between the dynamic system and the static system, which conforms to the principle of invariance of the speed of light, is formally the same, called the inverse Lorentz transformation, they are

$$x = \gamma(x' + vt')$$

$$t = \gamma\left(t' + \frac{v}{c^2} \cdot x'\right)$$

$$y = y'$$

$$z = z'$$

In the process of learning the special theory of relativity, we found a lot of places worth discussing, the following point out one by one, welcome teachers' criticism and correction [1-3].

2. Principle of Invariance of Light Speed

2.1. “the Length of Bar in Static System” and “the Length of Bar in Dynamic System”

Einstein said that by placing a rigid rod at the origin of the static system and using a unit rigid measuring rod, the measured length of the rigid rod is called “the length of the rod in the static system”.

At the origin of the moving system, an identical rigid rod is placed, and the same unit rigid measuring rod is used in the static system. The length of the rigid rod measured in the moving system is the same as that measured in the static system, which is also called “the length of the rod in the static system”.

But Einstein said that if, at the same time, the two ends of a rigid bar in a moving system, the corresponding points in a static system, were plotted. Then in the static system, the unit measuring rod in the static system is used to measure the distance between the two endpoints marked. The value thus obtained is different from the value of “the length of the bar in the static system” and is called “the length of the bar in the dynamic system”. The result is that the length of the bar in the moving frame is a little longer than the length of the bar in the static frame, and the length of the bar in the static frame is a little shorter than the length of the bar in the moving frame [1-2].

It should be pointed out that:

(1) For the same measuring rod, no matter in the static system or the dynamic system, the length of the measuring rod and the modulus of this vector are the same in their respective space-time, and there is no change.

(2) That is to say, the unit vectors of the respective space-time are used to measure the length vectors of the corresponding space-time between two points, and their moduli are the same.

(3) But one can never get a unit vector of length in a dynamic system. You can only use a unit vector of length in a static system.

(4) Thus, the corresponding length of the distance between two points in the static system is "the length of the distance between two points in the static system", and in the dynamic system is "the length of the distance between two points in the dynamic system".

(5) As a result, "the length of the distance between two points in a moving system" is a little longer than "the length of the distance between two points in a static system", and "the length of the distance between two points in a static system" is a little shorter than "the length of the distance between two points in a moving system".

(6) "The length of distance between two points in a dynamic system" contraction factor (σ) = "the length of distance between two points in a static system"

$$\sigma = \frac{1}{\gamma} = \sqrt{1 - \frac{v^2}{c^2}}$$

(7) In the static system and the dynamic system, the corresponding lengths between two points are

$$vt \rightleftarrows vt'$$

$$x \rightleftarrows x' + vt'$$

$$x - vt \rightleftarrows x'$$

(8) Therefore, there is the following relation

$$\sigma \cdot vt' = vt \Rightarrow t' = \frac{t}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$\sigma \cdot (x' + vt') = x \Rightarrow x = \sqrt{1 - \frac{v^2}{c^2}} \cdot (x' + vt')$$

$$\sigma \cdot x' = x - vt \Rightarrow x' = \frac{x - vt}{\sqrt{1 - \frac{v^2}{c^2}}}$$

2.2. "The time between two Points in static System" and "The time between two points in dynamic System"

For convenience, we will consider only the case where the starting point is the origin of a stationary reference frame.

According to Einstein's statement about "the length of the bar in the static system" and "the length of the bar in the dynamic system", the optical signal, in the static system and the dynamic system, the corresponding length between two points is the same, does not change. And according to the invariable principle of the speed of light, length and time are directly proportional. For optical signals, the corresponding time between two points in static and dynamic systems is also the same and does not change. They are called "the time between two points in static system". It should be noted that the time referred to here is: in their respective space-time, with their respective unit time, to determine their respective time, the value obtained. As in the case of length, we only have unit time in the static system and never have unit time in the dynamic system. In fact, if we use the unit time of the static system to measure the time corresponding to two points in the dynamic system, the value obtained is not the same as the time between two points in the static system, which we call the time between two points in the dynamic system. As in the case of length, the time between two points in a moving frame is a little longer than the time between two points in a stationary frame, and the time between two points in a stationary frame is a little shorter than the time between two points in a moving frame.

Because the speed of light is the same in both the moving and the static systems, and the length is directly proportional to time, the contraction factor for the moving and the static time is the same as the contraction factor for the length

$$\sigma_{time} = \sigma_{length} = \frac{1}{\gamma} = \sqrt{1 - \frac{v^2}{c^2}}$$

So there is

$$\sigma \cdot t' = t \Rightarrow t' = \frac{t}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Because

$$t' = \frac{t}{\sqrt{1 - \frac{v^2}{c^2}}} \neq \frac{t - \frac{v}{c^2}x}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$x = \sqrt{1 - \frac{v^2}{c^2}} \cdot (x' + vt') \neq \frac{x' + vt'}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Therefore, the Lorentz transformation is not true.

3. Principle of Relativity

The principle of relativity says that all the laws of physics have the same expression in different inertial systems.
In dynamic and static systems, the corresponding lengths between two points are

$$x' \rightleftarrows x - vt$$

$$x' + vt' \rightleftarrows x$$

By the principle of relativity, we have

$$\sigma \cdot vt = vt' \Rightarrow t = \frac{t'}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$\sigma \cdot (x - vt) = x' \Rightarrow x' = \sqrt{1 - \frac{v^2}{c^2}} \cdot (x - ct)$$

$$\sigma \cdot x = x' + vt' \Rightarrow x = \frac{x' + vt'}{\sqrt{1 - \frac{v^2}{c^2}}}$$

So, we have

$$t' = \frac{t}{\sqrt{1 - \frac{v^2}{c^2}}}, t = \frac{t'}{\sqrt{1 - \frac{v^2}{c^2}}} \Rightarrow t' = \frac{t'}{1 - \frac{v^2}{c^2}} \Rightarrow v = 0$$

$$x = \sqrt{1 - \frac{v^2}{c^2}} \cdot (x' + vt'), x = \frac{x' + vt'}{\sqrt{1 - \frac{v^2}{c^2}}} \Rightarrow 1 - \frac{v^2}{c^2} = 1 \Rightarrow v = 0$$

$$x' = \frac{x - vt}{\sqrt{1 - \frac{v^2}{c^2}}}, x' = \sqrt{1 - \frac{v^2}{c^2}} \cdot (x - vt) \Rightarrow 1 - \frac{v^2}{c^2} = 1 \Rightarrow v = 0$$

The conclusion is inconsistent with the known conditions, the relativity principle is not tenable, motion does not change the length and time of space-time. The Galilean transformation of Newtonian mechanics is correct, and the Lorentz transformation of special relativity is wrong [3].

4. Forward Transformation and Inverse Transformation of Lorentz Transformation

The forward transformation should be a transformation between a dynamic and a static system

$$x' = \gamma (x - vt)$$

The inverse transformation should be the transformation between "the original static system as a dynamic system" and "the original dynamic system as a static system"

$$x = \gamma (x' + vt')$$

However, they are not the corresponding forward and inverse transformations. The corresponding positive and contravariant transformation must be the corresponding line segment between the two points in the dynamic and static systems. So, the real forward and inverse transformations of these two expressions are

$$x' = \gamma (x - vt) \rightleftarrows x - vt = \gamma \cdot x'$$

$$x' + vt' = \gamma \cdot x \rightleftarrows x = \gamma \cdot (x' + vt')$$

And in this way, we can get

$$x' = \gamma (x - vt) = \gamma^2 \cdot x' \Rightarrow \gamma = 1$$

$$x = \gamma (x' + vt') = \gamma^2 \cdot x \Rightarrow \gamma = 1$$

$$t' = \gamma \left(t - \frac{v}{c^2} x\right) = t - \frac{v}{c^2} x \Rightarrow t - t' = \frac{v}{c^2} x$$

$$t = \gamma \left(t' + \frac{v}{c^2} x'\right) = t' + \frac{v}{c^2} x' \Rightarrow t - t' = \frac{v}{c^2} x'$$

$$\Rightarrow \frac{t-t'}{t-t'} = \frac{x}{x'} \Rightarrow x = x'$$

$$\because x^2 - c^2t^2 = x'^2 - c^2t'^2$$

$$\therefore t' = t$$

$$\gamma = 1 \Rightarrow \sqrt{1-\frac{v^2}{c^2}} = 1 \Rightarrow v = 0$$

These results contradict what we already know, so the Lorentz transformation is not true [3].

5. How is γ Determined?

The way to determine γ in general college physics textbooks [3] is

$$x' = \gamma(x - vt)$$

$$x = \gamma(x' + vt')$$

$$x' = ct'$$

$$x = ct$$

$$c^2tt' = \gamma^2(c-v)(c+v)tt'$$

$$\gamma^2 = \frac{c^2}{c^2 - v^2}$$

$$\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$$

It should be pointed out that:

(1) x'= γ (x-vt) is the forward transformation function, and x= γ (x' -vt') is the inverse transformation function. But they are not the corresponding forward and inverse transformation between two points.

(2) Relativism is widely used in physics. "Relative" only refers to the relationship between "objects of comparison", and the nature of each noumenon will not change because of "comparison". For example, a train has a different relative speed from different trains, but its own speed does not change.

(3) For the sake of illustration, we shall call the usual relativistic "stationary frame" the "ground frame" and the usual relativistic "motion frame" the "train frame".

(4) Different reference systems, although there are different "unit vectors of length". But we can only have, and only use, unit vectors of length in the ground reference frame.

(5) Using the unit vector of the length of the ground reference system, the measured values of the length vector of the ground reference system and the length vector of the train reference system are independent of which reference system the viewer regards as static and which reference system as moving.

(6) In this way, we can say that the distance between two points, the length of the ground reference system is the shortest, and the length of the train reference system becomes longer relative to the length of the ground reference system, i.e.

"The length of train reference frame" • "Contraction factor" = "The length of ground reference frame" (inverse transformation)

"The length of train reference frame" =γ• "The length of ground reference frame" (positive transformation) such

$$x' = \gamma(x - ct)\ (positive\ transformation)$$

$$x = \sigma(x' + ct') \neq \gamma(x' + ct')\ (inverse\ transformation)$$

(7) The error made by special relativity here is, in effect, that the proportionality coefficients of a direct proportional function of one variable are the same as those of its inverse function. However, the scaling coefficient of a direct scaling function of one variable, and the scaling coefficient of its inverse function, are reciprocal, is the most basic mathematical knowledge.

$$\sigma = \frac{1}{\gamma} = \sqrt{1-\frac{v^2}{c^2}}$$

$$\gamma = \frac{1}{\sigma} = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$$

(8) The derivation process of Lorentz transform, without exception, uses the two formulas of optical signal

$$x' = ct', x = ct$$

But when pushed to

$$x' = \frac{x - vt}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$t' = \frac{t - \frac{v}{c^2}x}{\sqrt{1 - \frac{v^2}{c^2}}}$$

It stops, obviously, in order to make do with Lorenz's Lorentz transformation. It claims to be the space-time coordinate transformation formula. Let's see, what is the ultimate form of the Lorentz transformation

$$x' = \frac{x - vt}{\sqrt{1 - \frac{v^2}{c^2}}} = \sqrt{\frac{c - v}{c + v}} \cdot ct = \sqrt{\frac{c - v}{c + v}} \cdot x$$

$$t' = \frac{t - \frac{v}{c^2}x}{\sqrt{1 - \frac{v^2}{c^2}}} = \sqrt{\frac{c - v}{c + v}} \cdot t$$

This is what we call the forward transformation, and the inverse transformation is

$$x = \frac{x' + vt'}{\sqrt{1 - \frac{v^2}{c^2}}} = \sqrt{\frac{c + v}{c - v}} \cdot ct' = \sqrt{\frac{c + v}{c - v}} \cdot x'$$

$$t = \frac{t' + \frac{v}{c^2}x'}{\sqrt{1 - \frac{v^2}{c^2}}} = \sqrt{\frac{c + v}{c - v}} \cdot t' = \sqrt{\frac{c + v}{c - v}} \cdot x'$$

The coefficients of the forward and inverse transformations are not equal and reciprocal

$$\sqrt{\frac{c - v}{c + v}} = \frac{1}{\sqrt{\frac{c+v}{c-v}}} \neq \sqrt{\frac{c + v}{c - v}}$$

$$\sqrt{\frac{c + v}{c - v}} = \frac{1}{\sqrt{\frac{c-v}{c+v}}} \neq \sqrt{\frac{c - v}{c + v}}$$

This also shows that the relativity principle of special relativity is wrong.

(9) x'= ct' is a wrong relation in physical sense and wrong in mathematical sense. x'= ct' is the distance difference between two events, ct' and vt'. x'= ct' -vt '= (c-v) t' is correct. The time corresponding to t' is the beginning and end of the light signal in the moving system, not the origin and end of the coordinate system.

(10) Such light rays as x' = ct' simply cannot exist. Because the origin of the moving frame, the train frame, is translated with the frame. Origin and destination are always at the same time. There is no ray that can travel from one point to another at the same time.

(11) If there are so many serious mathematical, physical and logical errors in a single derivation, the result must be wrong.

6. Lorentz Velocity Transformation Formula

$$u_{x'} = \frac{\mathrm{d}x'}{\mathrm{d}t'}, u_{y'} = \frac{\mathrm{d}y'}{\mathrm{d}t'}, u_{z'} = \frac{\mathrm{d}z'}{\mathrm{d}t'}$$

$$u_x = \frac{\mathrm{d}x}{\mathrm{d}t}, u_y = \frac{\mathrm{d}y}{\mathrm{d}t}, u_z = \frac{\mathrm{d}z}{\mathrm{d}t}$$

$$\mathrm{d}x' = \gamma(\mathrm{d}x - v\mathrm{d}t)$$

$$\mathrm{d}t' = \gamma\left(\mathrm{d}t - \frac{v}{c^2}\mathrm{d}x\right)$$

$$\mathrm{d}y' = \mathrm{d}y, \mathrm{d}z' = \mathrm{d}z$$

$$\mathrm{d}x = \gamma(\mathrm{d}x' + v\mathrm{d}t)$$

$$\mathrm{d}t = \gamma\left(\mathrm{d}t' + \frac{v}{c^2}\mathrm{d}x'\right)$$

The forward transformation

$$u_{x'} = \frac{\mathrm{d}x'}{\mathrm{d}t'} = \frac{u_x - v}{1 - \frac{v}{c^2}u_x}$$

$$u_{y'} = \frac{\mathrm{d}y'}{\mathrm{d}t'} = \frac{u_y}{1 - \frac{v}{c^2}u_x} \cdot \sqrt{1 - \frac{v^2}{c^2}}$$

$$u_{z'} = \frac{\mathrm{d}z'}{\mathrm{d}t'} = \frac{u_z}{1 - \frac{v}{c^2}u_x} \cdot \sqrt{1 - \frac{v^2}{c^2}}$$

The inverse transformation

$$u_x = \frac{\mathrm{d}x}{\mathrm{d}t} = \frac{u_{x'} + v}{1 + \frac{v}{c^2}u_{x'}}$$

$$u_y = \frac{\mathrm{d}y}{\mathrm{d}t} = \frac{u_{y'}}{1 + \frac{v}{c^2}u_{x'}} \cdot \sqrt{1 - \frac{v^2}{c^2}}$$

$$u_z = \frac{\mathrm{d}z}{\mathrm{d}t} = \frac{u_{z'}}{1 + \frac{v}{c^2}u_{x'}} \cdot \sqrt{1 - \frac{v^2}{c^2}}$$

We believe that:

(1) For a particle moving uniformly, its velocity

$$u = \frac{\textit{the corresponding length between two points}}{\textit{the corresponding time between two points}}$$

If the length and time are not corresponding, it doesn't make sense to express the velocity of the particle in terms of their derivative.

(2)

$$u_{x'} = \frac{\mathrm{d}x'}{\mathrm{d}t'} = \frac{u_x - v}{1 - \frac{v}{c^2}u_x}$$

It doesn't make sense because

$$x' = u_{x'}t'$$

is a physically false, mathematically false relation, x' is the distance difference between two events, i.e.

$$x' = u'_x t' - vt' = (u'_x - v)\, t'$$

That's the correct expression. The time corresponding to t' is the beginning and end of the particle in the moving system, not the origin and end of the coordinate system.

(3)

$$u_{x'} = \frac{\mathrm{d}x'}{\mathrm{d}t'} = \frac{u_x - v}{1 - \frac{v}{c^2}u_x}$$

Such a particle cannot exist at all. Because the origin of the moving frame, the train frame, is translated with the frame. Origin and destination are always at the same time. There is no particle that can travel from one point to another at the same time.

(4)

$$t' \rightleftarrows x' + vt' \rightleftarrows x \rightleftarrows t$$

$$u'_x = \frac{\mathrm{d}\,(x' + vt')}{\mathrm{d}t'} = \frac{\mathrm{d}[\gamma\,(x' + vt') \cdot \frac{1}{\gamma}]}{\mathrm{d}t'} = \frac{\frac{1}{\gamma}\mathrm{d}x}{\mathrm{d}\,(t - \frac{v}{c^2}x)} = \frac{u_x}{1 - \frac{v}{c^2}u_x} \cdot \sqrt{1 - \frac{v^2}{c^2}} \neq \frac{u_x - v}{1 - \frac{v}{c^2}u_x}$$

(5) The time on the vertical axis of the motion reference system is the corresponding time of the origin of the coordinate system in the corresponding inertial system

$$t_{y'|x'=0,x=vt} = t_{z'|x'=0,x=vt} = \frac{t - \frac{v}{c^2} \cdot vt}{\sqrt{1 - \frac{v^2}{c^2}}} = \sqrt{1 - \frac{v^2}{c^2}} \cdot t$$

$$t_{y|x=vt,x'=0} = t_{z|x=vt,x'=0} = \frac{t' - \frac{v}{c^2} \cdot 0}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{t'}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$u'_y = \frac{dy'}{dt'} = \frac{u_y}{\sqrt{1-\frac{v^2}{c^2}}} \neq \frac{u_y}{1-\frac{v}{c^2}u_x}\sqrt{1-\frac{v^2}{c^2}}$$

$$u'_z = \frac{dz'}{dt'} = \frac{u_z}{\sqrt{1-\frac{v^2}{c^2}}} \neq \frac{u_z}{1-\frac{v}{c^2}u_x}\sqrt{1-\frac{v^2}{c^2}}$$

$$u_y = \frac{dy}{dt} = \sqrt{1-\frac{v^2}{c^2}} \cdot u'_y \neq \frac{u'_y}{1+\frac{v}{c^2}u_x}\sqrt{1-\frac{v^2}{c^2}}$$

$$u_z = \frac{dz}{dt} = \sqrt{1-\frac{v^2}{c^2}} \cdot u'_z \neq \frac{u'_z}{1+\frac{v}{c^2}u_x}\sqrt{1-\frac{v^2}{c^2}}$$

According to Einstein's thought process, we have raised so many questionable questions for only one purpose. We believe that science is in the process of questioning and being questioned, so we feel that our work is still meaningful [3].

7. Conclusion

To question relativity, from beginning to end, we felt we had bitten off more than we could chew. However, the pursuit of truth, dare to challenge, cannot let the predecessors of the sense of responsibility, but always encouraged us to boldly present our own problems, let experts and scholars, teachers, fans of relativity, criticism and correction.

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