Time Coordinate Transformation From Reflection Symmetry

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The application of symmetry to physics leads to conservation law and conserved quantity. For inertial reference frames, the reflection symmetry generates not only conservation but also transformation. Under reflection symmetry, the elapsed time is conserved in all inertial reference frames. The displacement in space is also conserved in all inertial reference frames. From the conservation of the elapsed time and the displacement, the coordinate transformation between inertial reference frame is derived. Based on the coordinate transformation, both the time transformation and the velocity transformation are also derived. The derivation shows that all three transformations are dependent exclusively on the relative motion between inertial reference frames.

I. INTRODUCTION

Symmetry is important for physics. It is associated with conservation law and conserved quantity. For the inertial reference frames, the reflection symmetry together with translation symmetry account for several conserved quantities.

The symmetries relate both the velocity and the distance in one inertial reference frame to another inertial reference frame. With the velocity and the distance determined, the elapsed time in one inertial reference frame can be compared to the elapsed time in another inertial reference frame.

The conservation of the elapsed time leads to the coordinate transformation between inertial reference frames. Consequently, the transformations for the velocity and time can also be derived.

II. PROOF

Consider one dimensional motion.

A. Elapsed Time

The reflection symmetry can be applied to an isolated system of two persons.

Let the rest frame of a person P_1 be F_1. P_1 is stationary at the origin of F_1. Let another person P_2 be at a position x in F_1.

Let the rest frame of P_2 be F_2. P_2 is stationary at the origin of F_2. From the relative reflection symmetry, P_1 is at the position of -x in F_2.

Let F_2 move at the speed of v relative to F_1. From the relative reflection symmetry, F_1 is moving at the speed of -v relative to F_2.

Let t_1 be the time of F_1. P_2 moves at the speed of v in F_1. This motion can be described as

$$\frac{dx}{dt_1} = v \tag{1}$$

Let t_2 be the time of F_2. P_1 moves at the speed of -v in F_2. This motion can be described as

$$\frac{d(-x)}{dt_2} = -v \tag{2}$$

From equations (1,2),

$$dt_2 = dt_1 \tag{3}$$

$$t_2 = t_1 + A \tag{4}$$

The time of F_1 differs from the time of F_2 by a constant A which can be set to zero or any value by the initial condition.

From equation (3), the elapsed time is conserved in both F_1 and F_2. If dt_1 is zero then dt_2 is also zero. *Two simultaneous events in one inertial reference frame are also simultaneous in another inertial reference frame.*

B. Length and Distance

The same symmetry can also be applied to a rod and an observer.

Let an observer P_1 move toward a stationary rod in F_1. P_1 moves at a speed of v relative to F_1. The ends of rod are at the positions of x_1^a and x_1^b in F_1. The length of the rod is L_1 in F_1.

$$L_1 = x_1^b - x_1^a \tag{5}$$

Let the rest frame of P_1 be F_2. From relative reflection symmetry, the rod moves at the speed of -v relative to F_2. x_1^a is represented by x_2^a in F_2. x_1^b is represented by x_2^b in F_2. The length of the rod is L_2 in F_2.

$$L_2 = x_2^b - x_2^a \tag{6}$$

In F_1, the rod is stationary. The elapsed time for P_1 to pass through the rod from end to end is T_1.

$$T_1 = \frac{L_1}{v} \tag{7}$$

In F_2, P_1 is stationary. The rod moves toward P_1 at the speed of -v. Let the location of P_1 be the origin of F_2. The elapsed time for x_2^a to reach P_1 is t_2^a.

$$t_2^a = \frac{0 - x_2^a}{-v} \tag{8}$$

The elapsed time for x_2^b to reach P_1 is t_2^b.

$$t_2^b = \frac{0 - x_2^b}{-v} \tag{9}$$

The elapsd time for the whole rod to pass through P_1 is T_2.

$$T_2 = t_2^b - t_2^a \tag{10}$$

From equations (6,8,9,10),

$$T_2 = \frac{L_2}{v} \tag{11}$$

From equation (3), the elapsed time is independent of reference frame.

$$T_1 = T_2 \tag{12}$$

From equation (7,11,12),

$$L_1 = L_2 \tag{13}$$

The length of the rod is conserved in all inertial reference frames.

C. Coordinate Transformation

Let x represent the position of P_1 in F_1. The time for P_1 to move to x_1^a is t_1^a.

$$t_1^a = \frac{x_1^a - x}{v} \tag{14}$$

P_1 is stationary at the origin of F_2. The time for the rod to move from x_2^a to the origin is t_2^a.

$$t_2^a = \frac{0 - x_2^a}{-v} \tag{15}$$

From equation (3), the elapsed time is conserved in both reference frames.

$$t_1^a = t_2^a \tag{16}$$

From equations (14,15,16),

$$x_2^a = x_1^a - x \tag{17}$$

P_1 moves at the speed of v relative to F_1. Let t_1 be the time of F_1. P_1 is located at O_1 when t_1 is 0.

$$x - O_1 = v * (t_1 - 0) \tag{18}$$

From equations (17,18),

$$x_2^a = x_1^a - v * t_1 - O_1 \tag{19}$$

This is the coordinate transformation from F_1 to F_2.

The coordinate transformation between inertial reference frames is dependent on the relative motion between reference frames. It is not dependent on the speed of light.

D. Time Transformation

Let t_2 be the time of F_2. x_2^a decreases with t_2 as the rod moves at the speed of -v relative to F_2. Let x_2^a be O_2 when t_2 is 0.

$$x_2^a - O_2 = -v * (t_2 - 0) \tag{20}$$

From equations (19,20),

$$O_2 - v * t_2 = x_1^a - v * t_1 - O_1 \tag{21}$$

$$t_2 = t_1 + \frac{O_1 + O_2 - x_1^a}{v} = t_1 + A \tag{22}$$

This is the time transformation from F_1 to F_2. A is a constant whose value depends on the initial condition. A can be set to zero if $O_1 + O_2$ is chosen to be equal to x_1^a.

The time transformation between inertial reference frames is dependent on the relative motion between reference frames. It is not dependent on the speed of light.

E. Velocity Transformation

Let P_2 be at the location x_1 in F_1. The location of P_2 in F_2 is represented by x_2. From equation (19),

$$x_2 = x_1 - v * t_1 - O_1 \tag{23}$$

The speed of P_2 in F_1 is v_1.

$$v_1 = \frac{dx_1}{dt_1} \tag{24}$$

The speed of P_2 in F_2 is v_2.

$$v_2 = \frac{dx_2}{dt_2} \tag{25}$$

From equations (23),

$$dx_2 = dx_1 - v * dt_1 \tag{26}$$

$$\frac{dx_2}{dt_1} = \frac{dx_1}{dt_1} - \frac{v * dt_1}{dt_1} \tag{27}$$

From equations (3,27),

$$\frac{dx_2}{dt_2} = \frac{dx_1}{dt_1} - \frac{v * dt_1}{dt_1} \tag{28}$$

From equations (24,25,28),

$$v_2 = v_1 - v \tag{29}$$

This is the velocity transformation from F_1 to F_2.

The velocity transformation between inertial reference frames is dependent on the relative motion between reference frames. It is not dependent on the speed of light.

III. CONCLUSION

The transformations for the coordinate, the velocity, and time are all dependent exclusively on the relative motion between the inertial reference frames. Contrary to Lorentz Transformation[1], these transformations are not dependent on the speed of light. All three transformations are the direct properties from symmetry. The distinctive difference between them and Lorentz transformation confirms that Lorentz transformation violates fundamental symmetry in physics and is not a valid transformation in physics.

For example, the conservation of the elapsed time in all inertial reference frames indicates that two simultaneous events are always simultaneous in all inertial reference frames. Consequently, time dilation is impossible and invalid in physics.

Another example is the conservation of the length in all inertial reference frames. Length contraction predicted by Lorentz Transformation is also impossible and invalid in physics.

Lorentz transformation is the foundation of the theory of Special Relativity[2]. All predictions from this theory are incorrect in physics because of the symmetry violation by Lorentz transformation. Any experimental verification of this theory is impossible due to the error in Lorentz transformation.

[1] H. R. Brown (2001), The origin of length contraction: 1. The FitzGeraldLorentz deformation hypothesis, American Journal of Physics 69, 1044 1054. E-prints: gr-qc/0104032; PITT-PHIL-SCI00000218.
[2] Reignier, J.: The birth of special relativity - "One more essay on the subject". arXiv:physics/0008229 (2000) Relativity, the FitzGerald-Lorentz Contraction, and Quantum Theory
[3] Eric Su: List of Publications, http://vixra.org/author/eric_su