Time and Reference Frame

Eric Su
eric.su.mobile@gmail.com
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Time in a reference frame can be represented by a rotating ring with constant angular velocity. The rotational motion of this ring is not affected by any acceleration parallel to its axis of rotation. The rotation period remains constant as the ring accelerates along the axis of rotation. The rotation period in the rest frame of the ring is always constant. Therefore, the rotation period is independent of reference frame. The rotation period represents the elapsed time in a reference frame. As a result, the elapsed time is also independent of reference frame. Consequently, time is independent of reference frame.

I. INTRODUCTION

In physics, the velocity of an object remains constant if the acceleration of this object is perpendular to its velocity.

One example is the projectile motion in which the horizontal velocity is not affected by the vertical gravity. Another example is the circular motion in 3-dimensional space. The circular motion in the y-z plane is not affected by any acceleration in the x direction.

Let two identical objects orbit around each other. Such isolated twin-body system makes a perfect ring in circular motion in the COM frame (Center of Mass). The rotation period of this ring remains constant even if the ring is subject to an acceleration parallel to its axis of rotation.

This constant rotaion period is a good representation of time. Consequently, the ring can be used as a clock to indicate the time in a reference frame.

II. PROOF

Consider three-dimensional motion.

A. Circular Motion

A circular motion in the y-z plane is not affected by any acceleration in the the x direction.

Let a cirular ring rotate in the y-z plane. The rotation period of this ring is T. Place this ring under acceleration in the x direction. The rotational speed of this ring in the y-z plane remains constant. The rotation period of this ring is always T regardless of its velocity in the x direction.

B. Reference Frame

Let F_2 be the COM frame of this rotating ring. Let its axis of rotation point to the x direction. Its rotation period is T_2 in F_2.

Let F_2 be stationary relative to another reference frame F_1. The rotation period of this ring is T_1 in F_1. F_2 is identical to F_1 because they are stationary relative to each other. Therefore,

$$T_1 = T_2 \tag{1}$$

Place F_1 under a negative acceleration in the x direction relative to F_2. The ring begins to accelerate in the x direction in F_1. However, the rotation period of this ring is always T_1 in F_1 regardless of its velocity in the x direction. Therefore,

$$T_1 = T_2 \tag{2}$$

C. Time

A constant rotation is a precise representation of time. At the completion of a single rotation of this ring, the elapsed time in F_1 is T_1 while the elapsed time in F_2 is T_2.

Let t_1 be the time in F_1. Let t_2 be the time in F_2. Let F_2 be stationary relative to F_1. F_2 is identical to F_1. Therefore,

$$t_1 = t_2 \tag{3}$$

Set both t_1 and t_2 to zero and place F_1 under a negative acceleration in the x directon relative to F_2. At the end of N rotations of this ring,

$$t_1 = N * T_1 \tag{4}$$

$$t_2 = N * T_2 \tag{5}$$

From equation (2),

$$T_1 = T_2 \tag{6}$$

From equation (4),(5),(6),

$$t_1 = t_2 \tag{7}$$

The time in F_1 is the same time in F_2.

III. CONCLUSION

Time is independent of reference frame. The time in a reference frame moving relatively to a resting reference frame is the same time in that resting reference frame.

According to Lorentz Transformation[1], times in different inertial reference frames are different. This is clearly incorrect in physics. As proved in this paper, time is independent of inertial reference frame.

Lorentz Transformation was proposed on the assumption[7] that the speed of light is independent of inertial reference frame.

As the result of this incorrect assumption, Lorentz Transformation violates Translation Symmetry[3] and Conservation of Momentum[9,10,11,12] in physics. Translation Symmetry requires conservation of simultaneity[4], conservation of distance[5], and conservation of time[6]. All three conservation properties are broken by Lorentz Transformation.

Therefore, Lorentz Transformation is not a valid transformation in physics. Consequently, any theory based on Lorentz Transformation is incorrect in physics. For example, Special Relativity[7,8]

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