Time In Projectile Motion

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In the projectile motion under vertical gravity, the horizontal speed remains constant while the vertical speed increases. The elapsed time to travel over a fixed length in the horizontal direction remains constant regardless of the vertical speed. Such elapsed time is independent of any reference frame in vertical motion. Therefore, the elapsed time is independent of the reference frame. Consequently, time is independent of the reference frame.

I. INTRODUCTION

In physics, the speed 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. The elapsed time to travel over a constant distance in the horizontal direction is constant.

The constant elapsed time is a precise representation of time. Therefore, the horizontal movement of an object can be used as a clock to represent the time in a reference frame.

II. PROOF

Consider two-dimensional motion.

A. Projectile Motion

The speed of an object in the y direction is not affected by the acceleration in the the x direction.

Let an object move with a constant speed V in the y direction. Place this object under an acceleration in the x direction. The speed of this object in the y direction remains constant. Let L be a unit length.

The time for this object to travel over a distance of L in the y direction is T_L.

$$T_L = \frac{L}{V} \tag{1}$$

T_L remains constant as long as V remains constant.

B. Reference Frame

Let a reference frame F_2 move with velocity (0,-V) relatively to this object. Let another reference frame F_1 be stationary relative to F_2. T_L for this object in F_1 is T_1. T_L for this object in F_2 is T_2. F_2 is identical to F_1 because they are stationary relative to each other. Therefore,

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

Place F_1 under a negative acceleration in the x direction relative to F_2. The object begins to accelerate in the x direction in F_1. However, T_1 for this object is always T_L in F_1 regardless of the motion of this object in the x direction. Therefore,

$$T_1 = T_2 \tag{3}$$

C. Time

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,

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

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. After N elapsed time of T_L for this object,

$$t_1 = N * T_1 \tag{5}$$

$$t_2 = N * T_2 \tag{6}$$

From equation (3),

$$T_1 = T_2 \tag{7}$$

From equation (5),(6),(7),

$$t_1 = t_2 \tag{8}$$

The time in F_1 is the same time in F_2.

III. CONCLUSION

Time is independent of the 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 the inertial reference frame.

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