Uniform Relative Reciprocal Velocity in Lorentz -Einstein Transformations

مقلوب السرعة النسبية المنتظمة في تحويلات لورنتز - اينشتاين

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الخلاصة :

في هذه الدراسة ،تم تحويل سرعة البعد النسبية الى سرعة الزمن النسبية في معادلات السرعة النسبية، باستعمال مقلوب السرعة البعدية المساوية الى سرعة الزمن ،إذ تم استنتاج معادلة سرعة الزمن النسبية لجسمين متحركين باتجاه واحد أو باتجاهين متعاكسين ومحصلة سرعة الزمن النسبية لجسمين يتحركان بزاوية قائمة واقل منها ومحصلة سرعة الزمن لثلاثة مركبات والسرعة الزمنية الانتقالية والدوار نية المنتظمة باستعمال معادلات سرعة البعد المعروفة ، كذلك اشتقت تحويلات لورنتز- اينشتاين لاستعمال قاعدة مقلوب السرعة علاوة على إيجاد قيمة الزمن التقليدي النسبي المستغرق لجسمين يتحركان باتجاهات مختلفة بحيث يفترض أن قيمة الزمن تتحقق لجسيم أو أكثر .

إن معادلات مقلوب السرعة النسبية تمنح فكرة واضحة ومتكاملة ومفهوم عام حول الحركة التقليدية النسبية وكذلك حول النسبية الخاصة لجسيم يتحرك بسرعة زمنية فائقة.

Abstract

The relative dimension velocity were converted to the relative time velocity in all equations by using the reciprocal of the velocity that equal to the negative of time velocity. The equations of the relative time velocity of two moving particles are in the same and opposite direction. The resultant of time velocity of two moving particles travel with right and less right angle ,while the resultant of time velocity in three-components. The relative uniform translational and rotational time velocities are derived from the known dimension velocity equations. The Lorentz- Einstein transformations are converted by the principle formula(reciprocal). In addition to, the classical relative of elapsed time was produced in a different directions of two moving particles, so that the time values was postulate to verify the time of moving one particle or more. The new relative reciprocal equations give an obvious and complementary idea about the classical relative motion, whenever the special relativity of moving particles with very high time velocities are also verified.

Key wards: reciprocal, relative, velocity, Lorentz- Einstein transformation, translation, rotation.

Introduction

Kinematics treats the geometry of motion without taking into account their inertia[1].A relative concept must always be referred to a particular frame of reference, chosen by observer. Different observers may use different frame of reference. It is important to know how observations made by different observers are related[2]. In solving problems of mechanics, it is often more expedient to consider the motion of a particle simultaneously with respect to frames of reference, one of which is assumed to be fixed and the other moving in some specified way with reference to the first[3]. The motion performed in this case by the particle is called resultant, or combined motion. The method of resolving a motion into simpler motions by introducing a supplementary moving frame of reference is widely employed in kinematics calculations, thereby underling the practical value of the theory of resultant motion considered in this[4]. The stationary and motion are relative concepts that serve as frame of reference [1]. An event of motion has not only position; it also has a time of occurrence [5] .In pure geometry the theories of similar (reciprocal theorem of Betti and Raleigh) reciprocal and inverse figures (reciprocal diagram) have led to many extensions of science (e.g. the refractive index being proportional to the velocity or the reciprocal of velocity) [6] . The concepts generalize to time - varying and to vector – valued Morse functions [7]. It sometimes uses the reciprocal lattice for crystal structure. (Lima Siow) formulated equivalent principle that the kinetic acceleration is equal to the potential acceleration $(d^2r/dt^2 = -d\Phi/dr)$[8] .

This theoretical study referred to relative reciprocal of dimension velocity (time velocity)with respect to frame of reference and observer of moving body, due to Galilean transformation, also related to Lorentz(Einstein) transformation. These equations give a new general formula of relative motion of the particle with respect to fixed point or relative moving point in addition to the known relative equations. It is regarded an integrated equations to know the relative motions of bodies.

The relative reciprocal velocity of moving particles with respect to observer:

a)The relative time velocity of two particles:

The relative dimension velocity of a particle with respect to another in the same direction is equal to the difference of two dimension velocities. So the relative dimension velocity $v_{x(ab)}$ of a particle a have velocity $v_{x(a)}$with respect to a particle b have velocity $v_{x(b)}$ is given by [1]:

$$v_{x(ab)} = v_{x(a)} - v_{x(b)} \qquad (1)$$

Where x(ab) is the direction of a with respect to b in one dimension.

It was known that $v_x = -\frac{1}{v_t}$, (the displacement velocity is equal to negative of reciprocal time velocity) [5],substitute in eq.(1) :

$$-\frac{1}{v_{t(ab)}} = -\frac{1}{v_{ta}} + \frac{1}{v_{tb}} \qquad (2)$$

Or

$$v_{t(ab)} = -\frac{v_{ta}v_{tb}}{v_{ta} - v_{tb}} \qquad (3)$$

This equation represents the relative time velocity of two particles travel in the same direction, for ex. if:

$$v_{ta} = -0.2s/m, v_{tb} = -0.5s/m, then, v_{t(ab)} = -0.333s/m, v_{x(ab)} = 3m/s$$

If two particles travel in opposite direction, the equation becomes:

$$v_{x(ab)} = v_{x(a)} \pm v_{x(b)} \qquad (4)$$

And the relative time velocity of the two particles is:

$$-v_{t(ab)} = -\frac{v_{ta}v_{tb}}{v_{ta} \pm v_{tb}} \qquad (5)$$

For ex. ,if:

$$v_{ta} = -0.2s/m, v_{tb} = -0.5s/m, then, v_{t(ab)} = -0.1428s/m, and, v_{x(ab)} = 7m/s ,$$

b) Relative time of two traveling particles:

The relative time of two traveling particles in the same direction obtained from equation (3) and $v_x = -1/v_t$ [1] :

$$v_{x(ab)} = -1/v_{t(ab)} \qquad (6)$$

$$\frac{dt_{ab}}{dx_{ab}} = -\frac{\dfrac{\partial t_a \partial t_b}{\partial x_a \partial x_b}}{\dfrac{\partial t_a}{\partial x_a} - \dfrac{\partial t_b}{\partial x_b}} \qquad (7)$$

By integrating the above equation, the results:

$$dt_{ab} = \frac{\partial t_a \partial t_b dx_{ab}}{\partial x_a \partial t_b - \partial x_b \partial t_a} \qquad (8)$$

By dividing the right hand side with $\partial t_a \partial t_b$ obtained:

$$dt_{ab} = \frac{dx_{ab}}{v_{xa} - v_{xb}} \qquad (9)$$

If the distance $dx(ab) = \partial x_a = \partial x_b$,and conciliate from eq.(8) the results:

$$t = \frac{\partial t_a \partial t_b}{\partial t_b - \partial t_a} \qquad (10)$$

For ex.,if $\partial t_a = 2s, \partial t_b = 5s, t = 3.3333s$,that is the time difference between two particles travel in the same direction at equal distance.

In opposite direction, eq. (6) becomes:

$$\frac{dt_{ab}}{dx_{ab}} = \frac{\dfrac{\partial t_a \partial t_b}{\partial x_a \partial x_b}}{\dfrac{\partial t_a}{\partial x_a} + \dfrac{\partial t_b}{\partial x_b}} \qquad (11)$$

With the same method :

$$\int dt = \frac{\partial t_a \partial t_b}{\partial t_a + \partial t_b} \qquad (12)$$

c)The resultant of time velocity of a particle travel with right angle[2] :

Since $v_{x(ab)}{}^2 = v_{xa}{}^2 + v_{xb}{}^2$

$$(-\frac{1}{v_{t(ab)}})^2 = (-\frac{1}{v_{ta}})^2 + (-\frac{1}{v_{tb}})^2 \qquad (13)$$

So

$$v_{t(ab)} = \frac{v_{ta} v_{tb}}{\sqrt{v_{ta}{}^2 + v_{tb}{}^2}} \qquad (14)$$

$$v_{t(ab)} = \frac{\dfrac{\partial t_a \partial t_b}{\partial x_a \partial x_b}}{\sqrt{\dfrac{(\partial t_a)^2 (\partial x_b)^2 + (\partial t_b)^2 (\partial x_a)^2}{(\partial x_a \partial x_b)^2}}} \qquad (15)$$

$$v_{t(ab)} = \frac{\partial t_a \partial t_b}{\sqrt{(\partial t_a)^2 (\partial x_b)^2 + (\partial t_b)^2 (\partial x_a)^2}} \qquad (16)$$

If two particles move in an uniform time velocity, $\frac{\partial t_a}{\partial x_a} = \frac{\partial t_b}{\partial x_b}$

$$v_{t(ab)} = 0.7071 v_{ta} \qquad (17)$$

Also from eq.(16):

$$\int dt = \frac{\partial t_a \partial t_b}{\sqrt{(\partial t_a)^2 (\partial x_b)^2 + (\partial t_b)^2 (\partial x_a)^2}} dx$$

We can assume that $\partial t_a \partial x_b = \partial t_b \partial x_a = \alpha$,so the previous equation becomes[2]:

$$t = \frac{\partial t_a \partial t_b}{\sqrt{\alpha^2 + \alpha^2}} dx \qquad (18)$$

$$t = \frac{\partial t_a \partial t_b}{\sqrt{2} \partial t_a \partial x_b} dx \qquad (19)$$

$$t = 0.7071 \frac{\partial t_b}{\partial x_b} \sqrt{(dx_a)^2 + (dx_b)^2}$$

Or

$$t = 0.7071 \sqrt{t_a{}^2 + t_b{}^2} \qquad (20)$$

d)The resultant of two time velocities with angle less 90^o :

It is known that the resultant value of two displacement velocities give from the equation:

$$v_x{}^2 = v_{xa}{}^2 + v_{xb}{}^2 - 2 v_{xa} v_{xb} \cos\theta$$

By substituting with relation $v_x = -\frac{1}{v_t}$, we obtain

$$(-\frac{1}{v_{t(ab)}})^2 = (-\frac{1}{v_{ta}})^2 + (-\frac{1}{v_{tb}})^2 - 2(-\frac{1}{v_{ta}})(-\frac{1}{v_{tb}})\cos\theta$$

By simple mathematical treatment, results is:

$$v_{t(ab)} = \frac{v_{ta} v_{tb}}{\sqrt{v_{ta}{}^2 + v_{tb}{}^2 - 2 v_{ta} v_{tb} \cos\theta}} \qquad (21)$$

For ex.:

$v_{xa} = 2m/s, v_{xb} = 5m/s, v_{ta} = -0.5 s/m, v_{tb} = -0.2 s/m, \theta = 60^o, v_{x(ab)} = 4.3589 m/s,$

$v_{t(ab)} = -0.2294 s/m$

e)The resultant of time velocity in three-components:

To find the time velocity in perpendicular co-ordinates, we use the known vector relation[2]:

$$\vec{v_r} = \hat{i} v_x + \hat{j} v_y + \hat{k} v_z \qquad (22)$$

Since the displacement velocity vector is equal the negative of the reciprocal time velocity vector or[5]:

$$\vec{v_r} = -\frac{\hat{\lambda}}{v_t}$$

Here λ is unit vector of velocity in three dimension.

Then

$$\frac{\hat{\lambda}}{v_t} = \frac{\hat{i}}{v_{tx}} + \frac{\hat{j}}{v_{ty}} + \frac{\hat{k}}{v_{tz}}$$

The resultant of time velocity vector is given by:

$$\hat{\lambda}\, {v_t}^{-1} = \frac{\hat{i}\, v_{ty} v_{tz} + \hat{j}\, v_{tx} v_{tz} + \hat{k}\, v_{tx} v_{ty}}{v_{tx} v_{ty} v_{tz}} \qquad (23)$$

The magnitude of the time velocity vector 0btained with using eq.(22):

$$\frac{1}{{v_t}^2} = \frac{1}{{v_{tx}}^2} + \frac{1}{{v_{ty}}^2} + \frac{1}{{v_{tz}}^2}$$

Results:

$$v_t = \frac{v_{tx} v_{ty} v_{tz}}{\sqrt{{v_{ty}}^2 {v_{tz}}^2 + {v_{tx}}^2 {v_{tz}}^2 + {v_{tx}}^2 {v_{ty}}^2}} \qquad (24)$$

Ex:

$$v_x = 2m/s, v_y = 4m/s, v_z = 5m/s, v_{tx} = -0.5s/m, v_{ty} = -0.25s/m, v_{tz} = -0.2s/m,$$

$$v_r = 6.7082m/s, v_t = -0.1491s/m$$

f)Relative uniform translational time velocity:

Let us consider two observers o and o / that move, relative to each other, with translational uniform motion. Observer o sees observer o / moving with dimension velocity v_x while o / sees o moving with velocity $-v_x$,or o sees o / moving with time velocity v_{tx},while o / sees o moving with time velocity$+v_x$.

With v_x as their constant relative dimension velocity, we may write $\vec{oo'} = \vec{v}_x t$ and $\vec{v}_x = \hat{u}_x v_x$

By using the reciprocal concept : $\vec{oo'} = \vec{v}_x t = -\hat{u}_x \dfrac{t}{v_{tx}}$, the scalar product of two sides by $\hat{u}_x$ produce[3] :

$$\hat{u}_x \cdot \vec{v}_x t = -\hat{u}_x \cdot \hat{u}_x \frac{t}{v_{tx}}$$

$$v_x = -\frac{1}{v_{tx}}$$

Consider now a particle at point A as shown in Fig.(1), we see that[2] :

$$\vec{r}' = \vec{r} - \vec{v}_x t \qquad (25)$$

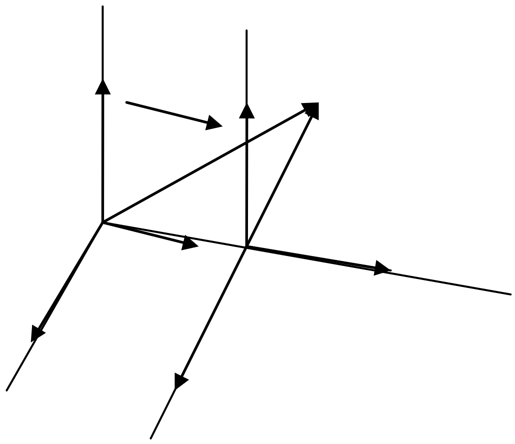

Fig.(1)Frames of reference in uniform relative translational motion[3]

The above vector equation can be separated into its three components, taking into account the fact that v_x is parallel to axis [2] :

$$x' = x - v_x t, y' = y, z' = z, t' = t \qquad (26)$$

The last equation that called a Galilean transformation, means that the time measurements are independent of the motion of the observer.
To find the same equations with respect to time velocity, the set equations simply become:

$$x' = x + \frac{t}{v_t}, y' = y, z' = z, t' = t \qquad (27)$$

The dimension velocity $\vec{V}_x$ of A relative to o is defined by:

$$\vec{V}_x = \frac{d\vec{r}}{dt} = \hat{u}_x \frac{dx}{dt} + \hat{u}_y \frac{dy}{dt} + \hat{u}_z \frac{dz}{dt} \qquad (28)$$

And the dimension velocity $\vec{V}'_x$ of A relative to o / is ,

$$\vec{V}'_x = \frac{d\vec{r}'}{dt} = \hat{u}_{x'} \frac{dx'}{dt} + \hat{u}_{y'} \frac{dy'}{dt} + \hat{u}_{z'} \frac{dz'}{dt} \qquad (29)$$

When $t = t'$ .Taking the derivative of eq.(25) relative to time and noting that $\vec{v}_r$ is constant, so we have:

$$\vec{V}_r{}' = \vec{V}_r - \vec{v}_r \qquad (30)$$

This equation may separate into the three dimension velocity components :

$$\vec{V}_{x'}{}' = \vec{V}_x - \vec{v}_x \; , \; \vec{V}_{y'}{}' = \vec{V}_y \; , \; \vec{V}_{z'}{}' = \vec{V}_z \qquad (31)$$

These equations give the Galilean rule for comparing the dimension velocity of a particle as measured by two observers to relative translational motion.

With respect to time velocity $\vec{V}'_t$ of A relative to o, we can be produce, the derivative of time with respect to co-ordinates by substituting in eq.(28):

$$\vec{V}_t = \hat{u}_r \frac{dt}{dr} = \hat{u}_x \frac{dt}{dx} + \hat{u}_y \frac{dt}{dy} + \hat{u}_z \frac{dt}{dz} \qquad (32)$$

The time velocity $\vec{V}'_t{}'$ of A relative to o′ depending on eq.(29):

$$\vec{V}_t{}' = \hat{u}_{r'} \frac{dt}{dr'} = \hat{u}_{x'} \frac{dt}{dx'} + \hat{u}_{y'} \frac{dt}{dy'} + \hat{u}_{z'} \frac{dt}{dz'} \qquad (33)$$

At $t = t'$,also substitute in eq.(30) by relations:

$$\vec{V}_r{}' = -\hat{U}_{r'} \frac{1}{V'_t}, \quad \vec{V}_r = -\hat{U}_r \frac{1}{V_t}, \quad \vec{v}_r = -\hat{u}_r \frac{1}{v_t}$$

Results:

$$-\frac{\hat{U}_{r'}}{V'_t} = -\frac{\hat{U}_r}{V_t} + \frac{\hat{u}_r}{v_t} \qquad (34)$$

The magnitude can be obtained by using the dimension derivatives in three space, returning to eq.(26)as follow :

$x' = x - v_x t$

Derive with respect to time :

$$\frac{dx'}{dt} = \frac{dx}{dt} - v_x$$

$$\frac{dt}{dx'} = \frac{dt}{dx - v_x dt} \qquad (35)$$

Divide the right side by dt we obtain :

$$V'_{tx'} = \frac{V_{tx} v_{tx}}{v_{tx} - V_{tx}} \qquad (36)$$

noting that $V_{tx} = \dfrac{dt}{dx}, v_{tx} = -\dfrac{1}{v_x}$

Separate into three time velocity components:

$$V'_{tx'} = \frac{V_{tx} v_{tx}}{v_{tx} - V_{tx}}, V'_{ty'} = V_{ty}, V'_{tz'} = V_{tz} \qquad (37)$$

These three equations give another Galilean rule of a particle as measured with time velocity by two observers in relative translational motion.

The dimension acceleration of A relative to o and o' is obtained by:

$\vec{a}_r = \dfrac{d\vec{V}_r}{dt}$ and $\vec{a}'_r = \dfrac{d\vec{V}'_r}{dt}$ respectively using the same t in both cases.

From equation (30) ,noting that $\frac{dv_x}{dt}=0$,because v_r is constant ,however we obtain[2] :

$$\frac{d\vec{V}_{X'}'}{dt}=\frac{d\vec{V}_x}{dt} \text{ or } \vec{a}_x{}' = \vec{a}_x \qquad (38)$$

Which expressed in rectangular coordinates, is $a'_{x'}=a_x, a'_{y'}=a_y, a'_z=a_z$

In other word ,both observers measure the same acceleration, that is, the acceleration of a particle is the same for all observers in uniform relative translational motion, or the dimension acceleration remains invariant when passing from one frame of reference to any other .

The time acceleration that equal the ratio of the change in time velocity to the traveled path(s/m^2) of a particle A relative to frame of reference o and o / or:

$a_{tx}=\frac{dv_{tx}}{dx}$ and $a'_{tx'}=\frac{dV'_{tx'}}{dx'}$ respectively

Here we use the same time t, but different x .

From eq.(37),differentiae with respect to x' :

$$\frac{dV_{tx'}{}'}{dx'}=\frac{(V_{tx}-v_{tx})[V_{tx}\frac{dv_{tx}}{dx}+v_{tx}\frac{dV_{tx}}{dx}]-v_{tx}V_{tx}[\frac{dV_{tx}}{dx}-\frac{dv_{tx}}{dx}]}{(v_{tx}-V_{tx})^2}$$

$$a_{tx}{}'=\frac{v_{tx}{}^2\frac{dV_{tx}}{dx}-V_{tx}{}^2\frac{dv_{tx}}{dx}}{(v_{tx}-V_{tx})^2}$$

So $a_{tx}{}'=\frac{V_{tx}{}^2 a_{tx}{}''-v_{tx}{}^2 a_{tx}}{(v_{tx}-V_{tx})^2}, a_{ty}{}'=\frac{dV_{ty}}{dy}, a_{tz}{}'=\frac{dV_{tz}}{dz}$ (39)

Where $a_{tx}{}''=\frac{dV_{tx}}{dx}$

In other words, both observers have the same time acceleration. That is, the time acceleration of a particle is the same for all observers in a uniform relative translational time motion. This result offers us an example of a new physical quantity – the time acceleration of a particle – that appears as the dimensional acceleration to independent of the motion of an observer, in other words, we have found that dimension or time acceleration remains invariant when passing from frame of reference to any other which is in uniform relative translational motion .

g)Uniform Relative Rotational Time angular velocity:

Let now consider two observers o and o / rotating relative to each but with no relative translational motion. For simplicity we shall assume that both o and o / are in the same region of space and that each uses a frame of reference attach to itself, but with common region. o / is rotating with dimension angular velocity reveres; o / observes frame XYZ with $\vec{\omega}_r$ .The position vector $\vec{r}$ of a particle A referred to XYZ is[2] :

$$\vec{r}=\hat{u}_x x+\hat{u}_y y+\hat{u}_z z \qquad (40)$$

$$\frac{d\vec{r}}{dt}=\hat{u}_x\frac{dx}{dt}+\hat{u}_y\frac{dy}{dt}+\hat{u}_z\frac{dz}{dt} \qquad (41)$$

Similarly, the position vector of A refereed to X′Y′Z′ is:

$$\vec{r}' = \hat{u}_{x'}\, x' + \hat{u}_{y'}\, y' + \hat{u}_{z'}\, z' \qquad (42)$$

The vector $\vec{r}$ is the same as in eq.(40).
The dimension velocity of A as measured by o$^{/}$ relative to its own frame of reference X′Y′Z′ is:

$$\frac{d\vec{r}'}{dt} = \hat{u}_{x'}\frac{dx'}{dt} + \hat{u}_{y'}\frac{dy'}{dt} + \hat{u}_{z'}\frac{dz'}{dt}$$

The time velocity by using the reciprocal dimension base with scalar quantity of eq.(41):

$$\frac{1}{v_{tr}} = \frac{1}{v_{tx}} + \frac{1}{v_{ty}} + \frac{1}{v_{tz}}$$

Or

$$v_{tr} = \frac{v_{tx}v_{ty}v_{tz}}{v_{ty}v_{tz} + v_{tx}v_{tz} + v_{tx}v_{ty}} \qquad (43)$$

For ex. $v_{tx} = -0.2s/m, v_{ty} = -0.5s/m, v_{tz} = 0.25s/m, v_{tr} = -0.09091s/m, v_r = 11m/s$

In taking the derivative of eq.(42),observer o$^{/}$ has assumed that his frame X′Y′Z′ is not rotating, and has therefore considered the unit vectors as constant in direction. However, observer o has the right to say that, the frame X′Y′Z′ is rotating and therefore the unit vectors $\hat{u}_{x'}, \hat{u}_{y'}, \hat{u}_{z'}$ are not constant in direction, and that in computing the time derivative of Eq.(42) one must write

$$\frac{d\vec{r}}{dt} = \hat{u}_{x'}\frac{dx'}{dt} + \hat{u}_{y'}\frac{dy'}{dt} + \hat{u}_{z'}\frac{dz'}{dt} + x'\frac{d\hat{u}_{x'}}{dt} + y'\frac{d\hat{u}_{y'}}{dt} + z'\frac{d\hat{u}_{z'}}{dt} \qquad (44)$$

Now the endpoints of vectors $\hat{u}_{x'}, \hat{u}_{y'}, \hat{u}_{z'}$ are (by assumption in uniform circular motion relative to o, with dimension angular velocity $\vec{\omega}_r$ .In other words $\frac{d\hat{u}_{x'}}{dt}$ is the dimension velocity of a point at unit distance from o and with uniform circular motion with displacement angular velocity $\vec{\omega}_r$.
Considering that R remains constant, we obtain :

$$v_s = \frac{ds}{dt} = R\frac{d\theta}{dt}$$

The quantity $\omega_\theta = \frac{d\theta}{dt}$ is called the dimension angular velocity (rad/s)

Since $R = r\sin\gamma, v_r = \omega_r r\sin\gamma \Rightarrow \vec{v}_r = \vec{\omega}_r \times \vec{r}$

Therefore

$$\frac{d\hat{u}_{x'}}{dt} = \vec{\omega}\times\hat{u}_{x'},\ \frac{d\hat{u}_{y'}}{dt} = \vec{\omega}\times\hat{u}_{y'},\ \frac{d\hat{u}_{z'}}{dt} = \vec{\omega}\times\hat{u}_{z'} \qquad (45)$$

According to eq.(44) we may write:

$$x'\frac{d\hat{u}_{x'}}{dt}+y'\frac{d\hat{u}_{y'}}{dt}+z'\frac{d\hat{u}_{z'}}{dt}=\vec{\omega}\times\hat{u}_{x'}\,x'+\vec{\omega}\times\hat{u}_{y'}\,y'+\vec{\omega}\times\hat{u}_{z'}\,z=\vec{\omega}_r\times\vec{r} \quad (46)$$

Introducing this result in eq.(44) and using eq (41) and (46) ,we get:

$$\vec{V}_r=\vec{V}_r{}'+\vec{\omega}_r\times\vec{r} \quad (47)$$

This expression gives the relation between the dimension velocities ν_r and ν'_r,as recorded by observer o and o / in relative distant rotational motion.

To obtain the relation between the dimension accelerations, we proceed in a similar way. The displacement acceleration of A, as measured by o relative to XYZ is[2]

$$\vec{a}_r=\frac{d\vec{V}_r}{dt}=\hat{u}_x\frac{dV_x}{dt}+\hat{u}_y\frac{dV_y}{dt}+\hat{u}_z\frac{dV_z}{dt} \quad (48)$$

The dimension acceleration of A, as measured by o / relative to X′Y′Z′ ,when he again ignores the rotation:

$$\vec{a}'_r=\hat{u}_{x'}\frac{dV_{x'}}{dt}+\hat{u}_{y'}\frac{dV_{y'}}{dt}+\hat{u}_{z'}\frac{dV_{z'}}{dt} \quad (49)$$

When we differentiate eq.(47) with respect to t, remembering that we are assuming that ω_r is constant, we obtain:

$$\vec{a}_r=\frac{d\vec{V}_r}{dt}=\frac{d\vec{V}'_r}{dt}+\vec{\omega}'_r\times\frac{d\vec{r}}{dt} \quad (50)$$

$$\vec{a}_r=\frac{d\vec{V}_r}{dt}=\frac{d\vec{V}'_r}{dt}+(\vec{\omega}'_r\times\vec{\nu}_r)$$

$$\vec{a}_r=\frac{d\vec{V}_r}{dt}=\frac{d\vec{V}'_r}{dt}+\vec{\omega}'_r\times(\vec{\omega}_r\times\vec{r})$$

$$\vec{a}_r=\vec{a}'_r+\vec{\omega}'_r\times(\vec{\omega}_r\times\vec{r}) \quad (51)$$

With respect to angular time velocity and linear time velocity by using the reciprocal velocity $\nu_r=-\frac{1}{\nu_t}$:

$$\because \nu_t=\frac{dt}{ds}=\frac{dt}{Rd\theta}=\frac{\omega_t}{R}$$

$$\omega_t=\nu_t r\sin\gamma \quad (52)$$

$$\therefore \vec{\omega}_t=\vec{\nu}_t\times\vec{r}$$

The direction of $\vec{\omega}_t$ is the same of direction of $\vec{\omega}_r$

For ex.ω_r=5rad/s,r=2m,$\gamma=30^o$,R=1m,Find ν_r,and verify

Solution: ν_r= 5m/s, ω_t=-1/5 s/rad

To find the displacement acceleration follow the equation:

$$\vec{a}_r = \frac{d\vec{\nu}_r}{dt}, \vec{\nu}_r = \vec{\omega}_r \times \vec{r} \qquad (53)$$

$$\vec{a}_r = \frac{d}{dt}(\vec{\omega}_r \times \vec{r}), \vec{\omega}_r = const.$$

$$\vec{a}_r = \vec{\omega}_r \times \frac{d\vec{r}}{dt} = (\vec{\omega}_r \times \vec{\nu}_r) \qquad (54)$$

For time acceleration :

$$a_t = \frac{d}{ds}\left(\frac{dt}{ds}\right) = \frac{d\nu_t}{ds} \qquad (55)$$

But $\nu_t = \frac{\omega_t}{r\sin\gamma}$

Derive with respect to distance becomes:

$$a_t = \frac{d}{ds}\left(\frac{\omega_t}{r\sin\gamma}\right)$$

But $ds = rd\theta$

$$\therefore a_t = \frac{d}{rd\theta}\left(\frac{\omega_t}{r\sin\gamma}\right)$$

Or $a_t = \frac{1}{r^2\sin\gamma}\left(\frac{d\omega_t}{d\theta}\right)$ (56)

But the time angular acceleration is $\alpha_t = \frac{d\omega_t}{d\theta}$

So $a_t = \frac{\alpha_t}{r^2\sin\gamma}$ (57)

Where ω_t is variable .

For ex. r =2m, $\gamma=30^o$,ω_r=5rad⁄s,υ_r=5m ⁄s, $a_r=\omega_r\upsilon_r\sin\gamma$=12.5m/s^2
α_t=25s/rad^2, ω_t=-1/5s/rad.

h)The Time Lorentz-Einstein Transformations:

The fourth equation in eq.(26) (t = t') can longer correct, so we may adjust the time as well as the distance if the quotient of the two is to remain the same for observers in relative motion as it does in the case of the dimension velocity of light, that equal to 2.9979 ×10^{8}m/s ,or equal to 3.335668×10^{-9}s/m or 3.335668ns/m in time velocity concept ,in other wards, the time interval between two events does not have the same for observers in relative motion.

The new transformation, which is compatible with invariant of the dimension velocity of light, is then[2],

$$x' = \frac{x - v_x t}{\sqrt{1 - \frac{v_x^2}{c_x^2}}}, y' = y, z' = z, t' = \frac{t - \frac{v_x x}{c_x^2}}{\sqrt{1 - \frac{v_x^2}{c_x^2}}} \quad (58)$$

Another new transformation, which is compatible with invariant of the time velocity of light, is then,

$$x' = \frac{x + \frac{t}{v_t}}{\sqrt{1 - \frac{c_t^2}{v_t^2}}}, y' = y, z' = z, t' = \frac{t + \frac{x c_t^2}{v_t}}{\sqrt{1 - \frac{c_t^2}{v_t^2}}} \quad (59)$$

Where $v_x = -\frac{1}{v_t}, c_x = \frac{1}{c_t}$

The two set equation is called the Lorentz dimension and time transformation respectively. Practically the value of k is equal to one for every dimension and time because c_r or c_t is a distance velocity and time velocity very large compared with the great velocities, that is also no difference between the Lorentzian and Galilean transformations in this case.

As we know the Lorentz – or relativistic – transformation must use for very fast particles as the electrons in atoms or particles in cosmic rays.

i)Transformation of dimension and time velocity

The dimension and time velocity of A as measured by o has components[2] :

$$V_x = \frac{dx}{dt}, V_y = \frac{dy}{dt}, V_z = \frac{dz}{dt}\ , V_{tx} = \frac{dt}{dx}, V_{ty} = \frac{dt}{dy}, V_{tz} = \frac{dt}{dz} \quad (60)$$

Similarly, the components of distance and time velocities of A as measured by o / are

$$V'_{x'} = \frac{dx'}{dt'}, V'_{y'} = \frac{dy'}{dt'}, V'_{z'} = \frac{dz'}{dt'}, V'_{t'x'} = \frac{dt'}{dx'}, V_{ty} = \frac{dt}{dy}, V_{tz} = \frac{dt}{dz} \quad (61)$$

Note that we now use dt' and not dt ,because t and t' are not longer the same. Differentiating equations (23) becomes:

$$dx' = k(dx - v_x dt) = k(V_x - v_x)dt, dy' = dy, dz' = dz, dt' = k(dt - v_x \frac{dx}{c_x^2} = k(1 - \frac{v_x V_X}{c_x^2})dt \quad (62)$$

Where $k = \frac{1}{\sqrt{1 - \frac{v_x^2}{c_x^2}}}, V_x = \frac{dx}{dt}$

In first and last equations, dx has been replaced by $V_x$dt, according to eq.(60) .Therefore dividing the first three of these equations by the fourth we obtain :

$$V'_x = \frac{dx'}{dt'} = \frac{V_x - v_x}{1 - \frac{v_x V_x}{c_x^2}}, V'_y = \frac{dy'}{dt'} = \frac{V_y}{k(1 - \frac{v_x V_y}{c_x^2})}, V'_z = \frac{dz'}{dt'} = \frac{V_z}{k(1 - \frac{v_x V_z}{c_x^2})} \quad (63)$$

also $k = \dfrac{1}{\sqrt{1 - \dfrac{c_t^{\,2}}{v_t^{\,2}}}}$

if $v_r = 0.8 c_r = 0.8 \times 3 \times 10^8 = 2.4 \times 10^8$ m/s

$c_t = 0.8 \times v_t = 0.8 \times 0.416625 \times 10^{-9} = 3.33 \times 10^{-9}$ s/m

This set of equations give the law for the Lorentz transformation of velocities , that is ,the role for comparing the velocity of a body or measured by two observers in uniform relative translational motion. A gain this reduces to eq.(26) for relative velocities which are very small compared with the velocity of light.

For length contraction and time dilation, the equation becomes :

$$L = \sqrt{1 - \frac{v_x^{\,2}}{c_x^{\,2}}}\, L' \qquad (64)$$

Or $$L = \sqrt{1 - \frac{c_t^{\,2}}{v_t^{\,2}}}\, L' \qquad (65)$$

$$T = \frac{T'}{\sqrt{1 - \frac{v_x^{\,2}}{c_x^{\,2}}}} = \frac{T'}{\sqrt{1 - \frac{c_t^{\,2}}{v_t^{\,2}}}} \qquad (66)$$

Where T' is the time interval measured by an observer $o^{/}$ at rest with respect to the point where the events occurred, and T is the time interval measured by an observer o relative to whom the point is in motion when the events occurred. That is, observer o saw the events occur at two different positions in space. Since the factor $\dfrac{1}{\sqrt{1 - \dfrac{c_t^{\,2}}{v_t^{\,2}}}}$ is larger than 1,equation (66) indicates that T is greater than T'.Therefore processes appear to take longer time when they occur in a body in motion relative to the observer than when the body is at rest relative to the observer than when the body is at rest relative to observer ,that is $T_{motion} \rangle T_{rest}$.

Conclusions

Many equations of relative time velocity compatible with relative dimension velocity are produced to describe the translational and rotational relative motion of a body due to Galilean and Lorentz transformations. This is considered an addition equations to complete the concept of relative kinematical motion of a particle. All new equations that obtained from the known give the most meaning of the relative movement of the particle. The dimension movement of particles is not derive from as a general concept so that give the truth for translation or rotation. The calculating values of the relative dimension or time velocity are in agreement with each other. The idea about converting the two relative velocities to each other gives complementary to the fixed and moving observers with respect to dimension in addition to time.

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