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Illustration of the faulty maths of Special Relativity

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I have dealt with the problems with Special Relativity in many articles previously; this article is an attempt to highlight a fault with the maths of Special Relativity as simply as possible.

I have analysed the Lorentz transform derivation in previous articles and have gone into a great deal of study to try to find out how to correct the mistakes made by standard texts. This article is a simple straight forward illustration that the maths of Special Relativity if taken at face-value just does not work. I hope that serves as illustration that can be easily understood – that there is a problem with Special Relativity as it is as present.

I present first the straight forward Richtmyer-Kennard-Cooper's derivation of the Lorentz transform, [1] and after that I criticise it, showing that it does not work.

The two frames are in uniform translatory motion relative to each other.

They say:

Let us call the two frames S and S' and let the velocity of S' relative to S be v. Let coordinates and times of any event obtained when the frame S is used be denoted by x,y,z,t and those obtained for the same event when S' is used by x', y',z', t'. To make the relation between these variables as simple as possible, let us choose our axes so that the x and x' axes are parallel to V and thus slide along each other; let the y' and z' axes be parallel to y and z respectively . Let us also count time from the instant at which the origins of the coordinates O and O' coincide. The coordinates of O’ are measured in frame S are x= Vt, y=0,z =0. [WILL REFER TO THIS AS POINT*1]

Let the two origins coincide at t=0, t’ = 0, at which instant a light pulse is emitted from the common origin. Imagine that observers in S and S’ have arranged apparatus which enable them to follow the pulse as it moves outward from the source. By Einstein’s second postulate, observer O in frame S and observer O’ in S’ find the locus of the wavefront to be given respectively by:

x^2 +y^2+z^2 – c^2t^2 = 0 (2.2a)

x’^2 +y’^2+z’^2 – c^2t’^2 = 0 (2.2b)

Thus each observer finds the wavefront to be a sphere centered at his own origin, even though the origins of the two systems no longer coincide !

The equations y = y’ and z = z’, [POINT *2] we accept them without proof; powerful arguments based on the isotropy of space can be advanced for their validity.

Therefore we seek compatible relations between x’, x, t’, and t. As the origins pass, x = x’, and we choose t = 0 = t’. Because of the homogeneity of space and of the uniformity of natural laws in time we assume the relationships are linear and try:

x’ = alpha x + eta t   (2.3a)
t’ = epsilon x + gamma t   (2.3b)

where alpha, eta, epsilon, and gamma are constants to be determined.

At the origin of S’, x’ =0 and x = Vt, so by (2.3a)

0 = alpha Vt + eta t

Thus eta = - alpha V, and so

x’ = alpha (x – Vt)

Inserting this value of x’ and equation (3b) into equation (2b) yields

alpha^2 x^2 – 2alpha^2Vxt + alpha^2 V^2 t^2 + y^2 +z^2 – c^2 eta^2 x^2 – 2c^2 eta gamma xt – c^2 gamma^2 t^2 = 0

This result is compatible with equation (2a) only if

alpha^2 – c^2 eta^2 = 0
alpha^2Vxt – c^2 eta gamma = 0
c^2 gamma^2 - alpha^2 V^2 = 0

These three equations can be solved for the three unknowns alpha, gamma, and eta in terms of V and c and give

alpha = gamma = 1/sqrt (1-V^2/c^2)

and

eta = - gamma V/c^2 = - (V/c^2)/sqrt (1-V^2/c^2)

All constants are now determined, and we have:

x’ = (x – Vt)/sqrt (1-V^2/c^2)
y’ = y
z’ = z
t’ = (t - (Vx/c^2))/sqrt (1-V^2/c^2)

That is where they finish their derivation, so now to the protest.

POINT *1 gives us x= Vt, y=0,z =0.
POINT *2 gives us y = y’ and z = z’

this into:

x^2 +y^2+z^2 – c^2t^2 = 0 (2.2a)

x’^2 +y’^2+z’^2 – c^2t’^2 = 0 (2.2b)

gives :

V^2t^2 - c^2t^2 = 0

x’^2 – c^2t’^2 = 0

But the first equation : V^2t^2 - c^2t^2 = 0 gives us V = c

The whole derivation of the Lorentz transform was based on V= c

You just substitute that into the equations derived at the end:

$x' = (x - Vt)/\text{sqrt}(1-V^2/c^2)$
$y' = y$
$z' = z$
$t' = (t - (Vx/c^2))/\text{sqrt}(1-V^2/c^2)$

that just gives nonsense

For the first equation, its $x' = (x - ct)/\text{sqrt}(1-c^2/c^2) = (x-ct)/0 =$ infinity at first glance but really x = ct so is 0/0 which is indeterminate.

Zero divided by zero is when maths just collapses and no longer works.

The derivation of the Lorentz equations doesn't even work!

Reference

[1] Introduction to Modern Physics, F K Richtmyer, E H Kennard, John N Cooper, Tata McGraw- Hill Publishing company ltd., sixth edition, 1982, New Delhi, India p46- 47, 57- 59