PROJECT 5 - Critical Analysis of the Main Premises of Special Relativity: Lorentz & Minkowski

Completed on 14-Jun-2015 (14 days)

Motivation >

Original Intention

About 10 years ago, I was studying for my Master's Degree in Industrial Engineering specialising in energy. Most of the speciality subjects were related to either engines (& turbines) or Nuclear Engineering. More specifically, I had an introductory subject to Nuclear Engineering, mostly focused on Modern Physics theories (e.g., Relativity and Quantum Physics), which I found particularly interesting.

I have always felt that the Physics (and Engineering) approach to energy was somehow incomplete; or, at least, that a comprehensive systematisation was missing. This feeling grew much stronger after improving my Modern Physics knowledge with the aforementioned subject. That's why I wondered myself: why not putting all these ideas together? I have a good knowledge about different types of energy (from a theoretical and calculations perspective) and am not bad at systematising more or less complex sets of ideas. Why not trying to come up with a good enough definition of energy? It would just be a relaxed mentally challenging distraction.

Note that I see theoretical developments as the required pre-step of a more or less immediate practical application; basically, the way in which most of engineering problems are faced (unlikely what happens in other more theoretical fields). For this reason, I never liked too much certain parts with a too-abstract or not-directly-applicable essence; for example, the famous E=mc^2 (or any other variant of this formula). The underlying static form of energy was completely against my (and the remaining theories') understanding of energy as "way to measure the transmission of movement". Bear in mind that certain movement is always present, even when dealing with potential energy (i.e., the one resulting from applying the given potential force when it becomes effective). On the other hand, Einstein's energy is expected to exist in absence of movement ("c" refers to an abstract speed which is not related in any way to the phenomenon whose energy is being analysed). Nevertheless, I (and the remaining theories) didn't have any problem to understand the underlying justification of this "static energy" (i.e., by bringing into account the potential or kinetic energies of the associated atoms); the real problem was finding a way to include a so abstract theory within the remaining forms of energy.

Thus, I do recognise that, when starting my analysis of Einstein's theory, my whole focus was put on finding certain not-too-right bit (or, more unlikely, a convincing set of reasons explaining how this theory could be seamless included within the remaining forms of energy). Perhaps that's why I was able to quickly come to certain conclusions, which might be seen as quite surprising.

At some point, I decided to share my findings with more people to know about their impressions. Unexpectedly, the fact of having more or less knowledge about this specific matter didn't seem to have any effect on the answers of these persons: all of them replied with the same (disappointing-to-me) indifference. Such negative results represented a good enough reason to stop working on my energy theory and to lose interest in all the related issues (e.g., the analysis included in this project). That is: I cannot see the point of working on something unless being completely certain about its practicality. I enjoyed this short attempt and my knowledge on various fronts was appreciably improved, but what would have been the point of continuing?

Current Motivation

Creating a new varocarbas.com project seemed the perfect excuse to make these personal conclusions public, even despite its sudden cancellation.

Nevertheless and as far as the main goal of varocarbas.com is contributing to improve customsolvers.com's visibility, all the projects here have to be fully compatible with the activity of the company. By bearing in mind that Custom Solvers 2.0 provides custom software development and numerical modelling services, at a first sight, this project might seem to not be fully compatible with it. On the other hand, critically analysing (mathematical) theories is an important step within the development of most of the numerical models. Additionally, this specific case represents a particularly good example of one of the basic principles which I apply at work: "clear separation between practical result(s) and tools accessorily utilised to achieve them"; together with objectivity and avoidance of any trendy/magical/unclear/abstract/not-properly-understood/etc. element.

In summary, the main intention of this project is to provide a new sample of my (& Custom Solvers 2.0's) ideas, knowledge and attitude; and even of its durable (written 10 years ago) and beyond-professional (a personal project which was started spontaneously) character.

Further Clarifications

Although both the origin of this project and its current motivation have already been clearly explained (Original Intention & Current Motivation), the critic to a so widely accepted theory might trigger some concerns which haven't been fully addressed.

Before reading the next sections, you should bear in mind the following ideas:

- This whole project is focused on mathematical aspects and, eventually, on general approaches regarding the best way to face a problem. Physics is only brought into picture for tangential (almost forced) reasons. Nevertheless, note that I have a relevant Physics background and that this analysis was originally faced from a Physics perspective.
- I have been as objective and neutral as possible, although always by bearing in mind the importance of the theory being analysed. In fact, when 10 years ago I came to the first (surprising) conclusions, I did reconsider my position various times despite its apparent clarity, because of thinking that ideas on the lines of "it cannot be true" were fully applicable.
- Although the main goal of this project is getting some visibility, I would like it to not be blown out of proportions. For me, this is just a descriptive enough example showing my attitude, knowledge and how I face certain problems.
- The contents of this project, equivalently to what happens with all my other promotional efforts (e.g., all the contents of varocarbas.com and customsolvers.com), are considered public domain and, as such, can be freely used by anyone without referring to me in any way. On the other hand, such a situation cannot be seen as an excuse to act dishonestly or unfairly.

In summary, any person wanting to discuss about this project will be more than welcome, for as long as good faith and proper understanding will be present. That is, I will not accept anything on the lines of: dogma-based claims which are completely ignoring the proposed arguments (e.g., "this is impossible because..."); unreasonable justifications with no mathematical support (e.g., "the intention in this part was..."); ignorance-driven attitudes (e.g., "I heard that..."); unrelated-to-this-project proposals (e.g., "here you have something I wrote about this other theory..."); or any other similar request.

Hopefully, I will be able to find a properly-understanding audience, who will plainly enjoy this project as intended (i.e., a self-promotion helping me to find compatible customers).

Lorentz Transformation >

General Analysis

NOTE: the text below refers to what was written by A. Einstein in "Relativity: The Special and General Theory" (you can download a copy from http://www.gutenberg.org/ebooks/30155). All the red-coloured numeric references are directly taken from that book.

The current section is mainly focused on Appendix I SIMPLE DERIVATION OF THE LORENTZ TRANSFORMATION (SUPPLEMENTARY TO SECTION 11).

The derivation is started from the following system of equations:

$x-ct = 0$ (1)

$x'-ct' = 0$ (2)

After performing some minor modifications, the aforementioned system is converted into:

$x' = ax-bct$ (5)

$ct' = act-bx$

At a first sight, it seems that (5) is not better than (1): the searched relationship (i.e., x' & t' related to x & t) has been artificially provoked by relying on two unknown constants (i.e., a & b); nevertheless, the original requirement of bringing further information into picture remains unaltered (i.e., previously, it had to explain the intended relationship; now, the meaning of the new constants).

Before analysing the next steps, I will clarify various issues whose misunderstanding is precisely the responsible for most of the subsequent errors:

- Although velocity is conventionally defined as $v = x/t$, its exact essence is transmitted better with the formula $v = \Delta x/\Delta t$. This second version emphasises the required variation between two points (i.e., $\Delta x/\Delta t = x2-x1/t2-t1$). That is: velocity represents the spatial variation (from $x1$ to $x2$) occurring during a given time period (from $t1$ to $t2$). No velocity could be considered unless both variations would be present (i.e., greater than zero).
- When performing any (mathematical) analysis, it is required to stick to the used assumptions throughout the whole process. That is: if at some point the relationship $a = bm$ is verified (i.e., in a general way, without being expressly constrained to work under certain conditions), it would have to be true at any other point too.
- When considering different scenarios to solve certain (mathematical) problem, the tested conditions would have to hold in all the considered situations. For example: with the equation $a = b+c$, knowing that c always equals 2 would certainly be helpful; unlikely what would happen with c only being 2 in some of the treated cases.

After the aforementioned equation (5), the derivation follows with:

For the origin of K' we have permanently $x' = 0$

Such an assumption is wrong for various reasons. Firstly, it goes against the already-explained fact that x' (better: $\Delta x'$) may not be zero. Otherwise, no velocity might have been considered; or, alternatively, the associated velocity (c) would be zero, what is impossible on account of its essence (i.e., constant value much bigger than zero). In fact, this clarification denotes a second error: forgetting about the unbreakable relationship between x' & t' (equivalently to what happens with x & t) through the constant c, what avoids these variables to be independent upon each other (i.e., x' might take any value above zero, but only as far as t' would also be equal to x'/c). There is a third error in the aforementioned statement: even in case that $x' = 0$ would be valid, it would have been a very bad choice on account of its extremely limited applicability; that is: the conclusions outputted for $x' = 0$ (e.g., $x = bct/a$) wouldn't work when such a condition is not met (i.e., when $x' \neq 0$, $x \neq bct/a$).

After all the aforementioned errors, the resulting formula $x = bct/a$ is converted into:

$v = bc/a$ (6)

Such a conversion occurs by creating a new variable (the velocity *v*) from the fraction *x/t*. That is: the author started from a fraction being equal to a constant and, after performing some formal replacements (i.e., not bringing any new information into picture), created a new variable defined by this same fraction. That is: $x/t = c$ & $x/t = v$ & $c \neq v$ (?!).

Afterwards, Einstein writes:
[...]we only require to take a "snapshot" of K' from K; this means that we have to insert a particular value of t (time of K), e.g. t = 0.

This "snapshot" represents a more intuitive way to understand the confusion between *x* (spatial coordinate) and *Δx* (variation between two spatial coordinates; what the *x* in $v = x/t$ is actually referring to): it is impossible to take a snapshot of a spatial variation or a velocity, it would rather be a video.

I will stop my analysis of this document here, because of not seeing the point in continuing. The aforementioned errors are so clear and "unfixable" that I cannot think of a better way to transmit the intended ideas.

Lastly, I want to highlight an issue which, unlikely what some people seem to think, I consider very relevant: better making sure that everything works fine before bringing the more elegant/magical/cool ideas in. That is: any experienced person should have assumed that this development was faulty just after having quickly skimmed through it. More specifically, after having noticed the starting conditions (i.e., a system of two inter-independent equations, each of them inversely relating two variables to the same constant), the additional information being accounted (i.e., none) and the final results:

(starting point) $x-ct = 0$

$x'-ct' = 0$

(final result) $x' = {}^{x-vt}/_{\sqrt{1-v^2/c^2}}$

$t' = {}^{t-xv/c^2}/_{\sqrt{1-v^2/c^2}}$

Even by ignoring the new *v* (where could a new variable come from?), it should have been clear that, without accounting for additional information, the proposed system cannot be solved.

Constancy of the Speed of Light

The validity of the Lorentz Transformation might be questioned even before analysing the multiple problems in its mathematical derivation, just by looking at one of its basic assumptions: the constancy of the speed of light.

When this theory was proposed, the available technical means were much more limited than the ones nowadays. And even today we are still not in a position to accurately measure what

happens with objects at speeds approaching the speed of light (i.e., light itself). Such a statement can easily be confirmed by analysing the currently accepted theory for the nature of light: sometimes it behaves as a wave and sometimes as a particle. Where "sometimes" should be interpreted as we are "still not able to adequately understand what is exactly happening"; we can just approximately measure some of the outputs usually generated within a given range. That is: the empirical confirmation/dismissal of the proposed idea was impossible when this theory was created and is impossible even 100 years later, when we are still not in a position to perform the required actions (i.e., set of reliable measurements under a wide variety of different conditions to undoubtedly conclude whether the speed of light should be considered constant or not).

By bearing in mind the aforementioned limitations in our understanding of this phenomenon, the proposed constancy of the speed of light shouldn't have ever been considered as a reliable assumption because of the following reasons:

- The fact of being almost a "blind shot", as far as the two possible results (i.e., being constant or not being constant) were equally probable on account of the limited available information. For example: after measuring the average speed of the runners at a given random point of a marathon, you shouldn't try to deduce the final positions. Or, at least, you shouldn't give the medals right away on account of such assumptions. On the other hand, why assuming constancy precisely on the boundaries of our understanding (i.e., we would have problems to see anything travelling faster than light)? For example: if we have an object which might travel at 10, but our tracking device can only measure up to 5, shouldn't we plainly accept the fact that we cannot know the speed of that object (at least, not above 5)? What would be the point of assuming that the speed of the object may not be faster than 5?
- Even in case of having fully accepted the reality (i.e., theory built on pure intuition), why assuming conditions which are very unlikely to be true according to our remaining experiences? For example: in nature, a big proportion of shapes, and even structures of somehow-coordinated elements, are circular (spherical); and, consequently, assuming that the shape of a not-clearly-seeable object is circular would be quite reasonable. But why assuming that a not-properly-understood natural phenomenon is constant when pure constancy virtually never occurs in nature? In fact, it is a commonly-used theoretical "trick" whose aim is precisely helping understand real, much more complex and actually-not-constant natural phenomena. On the other hand, considering a given behaviour as constant might be a valid (practical) solution to model certain reality under very specific conditions (e.g., assuming that the values of a given property are constant from the 10th decimal position onwards, because the maximum sensitivity of our technology is below the 5th decimal position). But the situation here was completely different: the constancy evolved into an ultimate truth, which was later used as the starting point to derive generally-applicable conclusions.

In summary, no theory with real applicability may be built on top of an assumption like the constancy of the speed of light, a very exceptional behaviour which cannot be validated.

Implications on Relativity

By assuming that the ideas proposed in the previous sections (mainly in General Analysis) are right, the Lorentz Transformation would be invalid and also most of the calculations in the Theory of Relativity. Note that the main intention of Einstein was precisely trying to explain certain physical phenomena (e.g., gravity) by applying the Lorentz Transformation, a system of equations assumed to measure (relative variations) of space and time more accurately than Classical Mechanics.

I will be analysing in more detail the exact implications on the Theory of Relativity in other sections (Practical Applicability & Theoretical Applicability). Nevertheless, a conclusion can already be drawn: if the Lorentz Transformation is wrong, most of the relativistic calculations would also be wrong.

Minkowski Space-time >

General Analysis

NOTE: the text below refers to what was written by A. Einstein in "Relativity: The Special and General Theory" (you can download a copy from http://www.gutenberg.org/ebooks/30155). All the red-coloured numeric references are directly taken from that book.

The current section is mainly focused on Appendix II MINKOWSKI'S FOUR-DIMENSIONAL SPACE ("WORLD") (SUPPLEMENTARY TO SECTION 17).

The analysis of the Minkowski theory is started in equation (11a), which is the last one in the previous Appendix I (where the Lorentz Transformation is discussed). As proven in Lorentz Transformation > General Analysis, this equation is already wrong. Nevertheless, some of the next steps are certainly worth noting and that's why I will continue the analysis anyway.

$$x'^2+y'^2+z'^2-c^2t'^2 = x^2+y^2+z^2-c^2t^2 \quad (11a)$$

In the next step, the previous equation is converted into (12) by performing these substitutions:

$$x_1 = x;\ x_2 = y;\ x_3 = z;\ x_4 = \sqrt{-1}ct;$$ (equivalent equations for the accented versions)

$$x'_1{}^2+x'_2{}^2+x'_3{}^2+x'_4{}^2 = x_1{}^2+x_2{}^2+x_3{}^2+x_4{}^2 \quad (12)$$

After performing this conversion, Einstein writes the following:
We see from (12) that the imaginary time co-ordinate x4, enters into the condition of transformation in exactly the same way as the space co-ordinates x1, x2, x3. It is due to this fact that, according to the theory of relativity, the "time" x4, enters into natural laws in the same form as the space co ordinates x1, x2, x3.

This text seems to indicate that a mere formal change in the variables is enough to convert space into time (?!). On the other hand, what is the exact point of some ambiguous remarks,

like quoting time or referring to an imaginary term? Was the author trying to create a "super-variable" with a dual space-time nature?

Such an intention is certainly not communicated to the mathematical derivation and, more specifically, to the units which remain unaltered. In SI, the units of the new temporal variable are metres, exactly the same than what happened before performing the aforementioned replacement. An unarguable conclusion by bearing in mind that velocity (*c*) is multiplied by time (logically, the fact of being constant does not make it unit-less. In any case, note that this constancy is also treated somewhere else). That is:

$$[SI]\ \sqrt{-1}c\ [m/s]\ t\ [s] \Rightarrow [m] \dashrightarrow x_4\ [m]$$

If you have a spatial variable (i.e., measured in spatial units), what would make you think that it is actually related to time? Or better: what would you do to let the mathematical derivation know about your intention? The answer is clear: there is nothing you can do to "convert" a spatial variable into a temporal variable (at least, by relying on Mathematics and/or Physics).

What is the right interpretation of x_4? It is just a spatial term which includes all the errors of the Lorentz Transformation. That is: a wrongly-generated element which was created while trying to extract inexistent information from a system of equations describing 3D space/time relationships. Additionally, the essence of this (already-wrong) term was arbitrarily converted from spatial into temporal (or weird space-time mixture), apparently for no other reason than agreeing with the statement *[...]due to this fact that, according to the theory of relativity, the "time" x4, enters into natural laws in the same form as the space co ordinates[...]*.

Implications on Relativity

The immediate consequence of having proven the invalidity of the Lorentz Transformation (mainly in Lorentz Transformation > General Analysis) is that most of the relativistic calculations are wrong. The fact that the mathematical derivation of Minkowski was also wrong (and not only because its derivation was started from the Lorentz Transformation) does not change this situation.

On the other hand, having proven the invalidity of the Minkowski's approach affects certain part of Einstein's theory which might be considered somehow beyond calculations: the 4-dimensional continuum.

All these ideas will be discussed in more detail in other sections (Practical Applicability & Theoretical Applicability).

Relativity Overview >

Practical Applicability

Physics is an eminently theoretical field and that's why this practical applicability has to be understood in the correct sense explained below. Additionally, note that the most relevant contribution of the Theory of Relativity (i.e., its more theoretical influence, which can easily be considered as an important quasi-philosophical part of the popular culture during almost the last 100 years) will be discussed in the next section.

Nowadays, the real applicability (e.g., calculations before creating a machine performing a given action) of pure Physics theories is very low. Note that highly-specialised fields of expertise (e.g., Engineering-related) are the ones in charge of coming up with the most adequate practical implementations of abstract Physics theories for each situation. On the other hand, Physics does play a very relevant theoretical role in all these other fields, whose importance cannot be dismissed.

Thus, the direct real-life applicability of the Theory of Relativity (i.e., immediate application of its equations as a pre-step to build something which might have a relevant effect on our lives) can safely be considered none. On the other hand, this theory might have been used as an inspiration for real-life implementations or to perform some preliminary calculations/estimations. Other than that, the calculations from this theory have a somehow important academic relevance, focused almost exclusively on highly-specialised theoretical areas. The effects of the current project on all these situations are identical: the calculations of the Theory of Relativity are wrong and, consequently, shouldn't be used.

Nevertheless, it is important to bear in mind the main reason explaining why the relativistic ideas have been considered valid (enough) for so long time: the fact of rarely being in a position to generate clearly wrong outputs. For objects moving notably slower than the speed of light (what happens most of the times), the outputs of this theory are virtually identical to the right ones (i.e., outputted by Classical Mechanics). For objects moving almost as fast as the speed of light (a quite exceptional scenario), we have the additional issue of being very difficult to exactly know what is really happening (as already explained in the corresponding section). Hence, this peculiarity (i.e., outputs very unlikely to be noticeably wrong) will certainly be very helpful to perform any required transition without too much trouble.

In summary, the conclusions of this project are not expected to provoke many companies to spend millions just to readapt entire systems; not even whole education plans to be completely redesigned. In fact, the main impact (although hopefully not too relevant) of this project is expected to be almost exclusively focused on theoretical aspects, as discussed in the next section.

Theoretical Applicability

The tremendous impact of the Theory of Relativity (and of A. Einstein) in the popular culture during almost the last 100 years was precisely the main reason to abandon the original version of this project 10 years ago. After having confirmed the low practical impact of the proposed critic and seen some initial (indifferent) reactions, I wondered why going further with something which might hurt some egos or even affect the faith of some people? To not mention the big impact of this theory on Modern Physics and a relevant proportion of the theoretical approaches after it.

As already explained, this project has been exclusively created for self-promotion purposes. More specifically and in application of Expectations 2.0, it should help me to approach a specific type of potential clients and to undoubtedly show my attitude (e.g., not having said a word in 10 years or critically analysing such a theory).

Nevertheless, I didn't start thinking about creating this project until after having satisfactorily addressed all my aforementioned concerns, mainly by relying on the two following ideas:

- On one hand, we have the science vs. religion bipartition with the associated properly-grounded vs. faith-based ideas. Even in case of considering as many intermediate stages as required (e.g., scientific-based argumentation until certain point), it seems that each approach should be accurately-enough positioned. Thus, if you want to call your theory pure science, you shouldn't mind well-reasoned criticism; or alternatively, in case of accepting a partially-religious essence, you might rely on some dogmas to plainly ignore any critic.
- Another quite-convincing-to-me reason resulted from my recent realisation about the negative impact that certain attitudes (i.e., not having the required knowledge but making decisions affecting others anyway) can have on people like me (i.e., completely aware about what do/don't know and making all the decision on account of such an understanding). This has provoked the transformation of my previous "don't want to hurt feelings" into "why should I tolerate some people to unfairly damage others (myself among them)?".

In summary, the conclusions of this project (i.e., the Theory of Relativity is wrong) can have a very relevant effect on quite a few fronts on account of the almost-divine status which this theory and its author have acquired. I will not analyse any of these implications, not even give my opinion about the likely-to-be-provoked attitudes. This is an objectivity-focused critic (i.e., mathematical derivation objectively wrong) which is expected to be analysed from an objective perspective. I hope that the aforementioned clarifications (together with the ones written in other sections) will avoid this project and me getting involved in any kind of faith-based discussion.