Some questionable ways of opposing the forwards and backwards movement of a rotating cylinder demonstration

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1) Ignoring the rules of the mathematical game.

A demonstration is a sequence of logical links, which are not very numerous in the considered case and so can be carefully examined step by step, in order to determine whether they are correct or not.

The reader, whom we suppose has a sufficient knowledge of relativity, is faced with only two possible alternatives:

− There is an error somewhere. If so it should be clearly pinpointed and the reason why it is an error should be explained precisely (or proved if necessary).

− No error is found. The reader must then admit the solidity of the demonstration.

A third conclusion such as "there is most likely an error but I cannot find it" is unacceptable.

2) Suggesting places where errors could lie, without examining further if there are actually errors in these places.

− There would be some idealization in the reasoning, consisting in neglecting some changes of shape, which would make the analysis flawed. There is no such idealization. The fact that we are in the case of 'negligible' relativistic effects is only used to state that the modifications of inertia momentum can be overpowered by sufficiently strong mechanical actions and so allow us to use the intermediate value theorem, which will show they can be cancelled exactly. Nothing is neglected indeed.

− The same goes for some supposed idealization of perfectly slippery friction. No friction is taken as actually being zero in this thought experiment. Zero friction is indeed considered, but only as a

reference point: if the contact were perfectly slippery, then the exchange of angular momentum would be zero. As soon as we consider a realistic non-slippery contact and attribute a value to friction, we are using as a reference the concept of perfectly slippery.

− Infinitesimal thickness is of course an idealization. But it cannot generate an inconsistency in the analysis, since it is merely a hypothesis. If one wishes, this result can be reformulated: "Assuming the concept of infinitesimal thickness, then this experiment leads to contradiction in the frame of special relativity". Thus the question is: do we have to assume the concept or not? The answer has to be 'yes', for three reasons.

a) As proved by non-standard analysis, infinitesimal numbers are legitimate, and their logical solidity is identical to that of ordinary numbers.

b) If we want special relativity not to be an empty bag – this would be a form of inconsistency − being allowed to consider objects in its frame is necessary. But, since the frame has to be flat, the quantity of material has to be infinitesimal. So the objects we can consider in special relativity are infinitesimal at least in one of their dimensions. What is necessary cannot be illegitimate, thus infinitesimal thickness is legitimate in the frame of special relativity.

c) Using infinitesimal elements is necessary to the analysis of the behaviour of elastic bodies, so considering infinitesimal objects, at least in one of their dimensions, is legitimate.

3) Claiming that if the demonstration was correct, the laws of special relativity would break down.

In fact, this is off the point: either the demonstration is correct, or it is not. But the paper *La modification minimale à apporter à la relativité restreinte pour qu'elle supporte l'expérience d'aller et retour d'un cylindre en rotation* shows that the demonstration does not imply this breakdown, and that all of the pragmatic part of special relativity, which is daily confirmed in particle accelerators, is not affected and can stay unchanged.

This paper is referenced at the end of the article *The forwards and backwards movement of a rotating cylinder experiment*, which I attach to this one as an appendix.

4) Claiming that the reason as to why the relativistic mechanics of elastic bodies run to contradiction is not explained

This is also off topic, and also false. The same paper gives a full explanation of that particular reason why.

5) Claiming that this work offers no new physical insight

That seems slightly exaggerated.

− This work states that relativistic Lorentzien mechanics of elastic bodies is non-consistent, as a consequence of the analysis of the forwards and backwards experiment.

− It explains the reason why this is so: the validity of the principle of relativity cannot be absolute.

− It points to the weakest modification that would remedy this inconsistence, which leads to a necessary theory, the Lorentzien non-relativity theory, the consistence of which for the mechanics of elastic bodies is proved in the paper *Preuve de la solidité logique de la non-relativité lorentzienne*. In this proof, the reason why we cannot state the consistency of relativistic Lorentzien mechanics of elastic bodies is pointed out.

This paper is also referenced at the end of the article *The forwards and backwards movement of a rotating cylinder experiment.*

− The reason why kinematics is Lorentzien is cleared up, which cannot be the reason given by Einstein, since he bases his reasoning on the principle of relativity and the invariance of the velocity of light.