Re: Rigid rod problem

Source: http://sci.tech−archive.net/Archive/sci.physics.relativity/2005−09/msg00254.html

- *From*: "Spoonfed" <jonathan.doolin@xxxxxxxxxxxxxxxxxxxxx>
- *Date*: 3 Sep 2005 04:57:27 −0700

russell@xxxxxxxx wrote:
> At t=0 *all* parts of the rod (not just one end) have v=0,
> but at that instant, everywhere, their a jumps discontinuously
> from 0 to some positive value that depends on position.
>

I agree: acceleration is a function of position. Even though the rod is rigid in its "own frame", for it to maintain that contraction, the different portions of it must be accelerating at different rates.

But since different parts of the rod are seen traveling at different speeds in this frame, does it always have its "own frame"?

I think so... An observer at either end of the stick should see the other end at rest, and all of the points in between at rest. As all of these points enter our temporarily comoving reference frame they will all come to a halt at the same coordinate time.

I guess this is the point you are making about "Born Rigid". If we start the acceleration from scratch, we need to apply it at certain points and at certain times. If we take an acceleration that is already underway, we can observe a rod that has come to an equilibrium after the beginning of the application of a force.

> This means that all the worldines are vertical at t=0 (since
> v=0) but they are all concave to the right at t=0 (since a>0).
> The concavity is greater at the rear because we have to make
> the acceleration greater there in order to maintain Born
> rigidity. The acceleration is greater there, but it doesn't
> happen earlier.
>
> (Of course we could have done the acceleration differently,
> but that would have produced a different diagram. Perhaps
> you even have such a diagram in mind; if so, I encourage
> you to reexamine the one whose link you posted.)
>

I think I already showed you this unfinished demo. I decided that the base and top of the platform should come to a rest at the same time.

http://www.spoonfedrelativity.com/files/myGravity−contractionvelocity.swf

However, I visualized the platform having the force of acceleration coming up from the base, as though a rocket were attached to the bottom.

Then the difference between the acceleration of the bottom and top could be accounted for by the speed of the compression wave through the material.

When the acceleration is FIRST applied to the base, there would be a lag between the initial acceleration of the bottom and the initial acceleration of the top. The entire platform would compress, and quickly come to the equilibrium state that you refer to as "born rigid"

After that, though, I wasn't 100% sure whether other inertial observers would see the two ends of the platform come to a stop at the same time or not.

By asking the question "Do the people on the platform see the ends moving apart?" and "When the people on the platform come momentarily to a halt, do you see the same thing they do?"

I answer these questions "No" and "Yes" respectively, and conclude that both ends must reach a zero velocity at the same time.

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- ***Follow−Ups***:
  - ♦ ***Re: Rigid rod problem***
    - ◊ *From:* Kim B
  - ♦ ***Re: Rigid rod problem***
    - ◊ *From:* Kim B

- ***References***:
  - ♦ ***Re: Rigid rod problem***
    - ◊ *From:* russell
  - ♦ ***Re: Rigid rod problem***
    - ◊ *From:* russell
  - ♦ ***Re: Rigid rod problem***
    - ◊ *From:* Spoonfed
  - ♦ ***Re: Rigid rod problem***
    - ◊ *From:* russell

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