An Experiment for Lorentz - Fitzgerald Contraction

Özgen Ersan

zgnrsn@gmail.com

Abstract: If length contraction is a reality, the electrical resistance value of a conductive cable must change in accordance with its different directions because of the Earth's universal motion. Trouton-Rankine experiment was replicated and reinterpreted by managing of precision in accordance with current methodology and cosmological knowledge. Our electrical resistance based experiment did not indicate an evidence for the length contraction; all measured values are isotropic.

Keywords: Special relativity, Light kinematics, Lorentz, Fitzgerald, Length contraction.

INTRODUCTION

When the Michelson – Morley interferometer experiment (MM) was set, the changing of fringes was an expectation in accordance with the directions because of the motion of the Earth / light in aether. As known, this experiment indicated inaccuracy for aether hypothesis (the amount of fringes does not change).

However, Fitzgerald claimed a brilliant idea: "if a length contraction is mentioned, this experiment MM cannot exclude the aether hypothesis". Length contraction hypothesis was a cleverly prophecy or deductive rescuer idea. Thereafter, some scientists wanted to prove the length contraction. Lorentz, Poincaré, Einstein and others generated theoretical remarks; they wanted to verify the length contraction. Actually, they had indirectly supported aether theory. Whereas, Trouton and Rankine had realized an experiment about length contraction in 1908 [1].

As known, the conductive cables have electrical resistance that can be changed by their length, by cross section area, and temperature etc; and this property can be measured by an ohmmeter. The measurements of resistances can indicate the length contraction on standardized conditions. The precision of ohmmeter and the management of precision are important for this experiment.

EXPERIMENT SETTINGS

1- The length of test object must be long enough and the section area must be small for the optimum ability of the ohmmeter.
2- We prefer varnished copper cable / coil wire ($\rho = 1.7 \times 10^{-8}$ Ω·m).
3- L = 450 m and A = 0.031416 mm^2 (0.031416×10^{-6} m^2).

R = ρ **L /A** = 244 Ω (DC theoretical static resistance) **(a)**

[**R**: Resistance (Ω, ohm; ρ: Resistivity (Ω·m); **L**: Length (m); A : section (m^2)

4- Universal motion and its direction of the Earth cannot be determined. Therefore a 3D wooden frame (like x, y, z coordinates) is formed and the cable was organized as a winding that is 1.00 meter. Three windings were attached to three (x, y, z) wooden arms (Fig. 1).

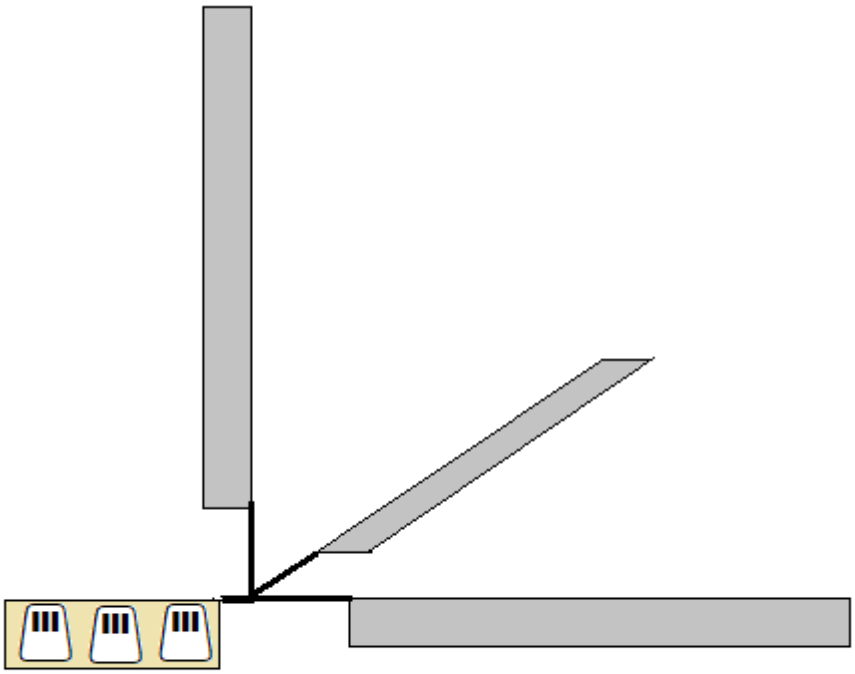

Figure 1- Test apparatus

5- Three digital ohmmeters (0 – 2000 Ω; resolution 1 Ω) were connected each of the cables.
6- Test apparatus will rotate manually for different directions.

If we may set proper direction for test apparatus and if Lorentz–Fitzgerald contraction is valid, the new resistance values must change according to its different inclinations. But the measured values were fixed as 251 Ω for all directions.

Any significant decreasing of value did not realize on all measurements.

This experiment was repeated randomly (in a year period and 24° C / 75° F) by considering the universal positions of the Earth; we could not determine a difference for any repetition.

DISCUSSION

1- When we measure a length of the test object by a length measuring instrument (tape ruler /meter) we cannot determine the effect of length contraction, it may be said that the tape of ruler is exposed to same length contraction too. But a similar effect is not mentioned for the electrical resistance measuring.

2- Probably we may not find a difference by measuring with the tape of meter for sizes of our bodies. However, there is not any blocking for feeling the changings. Eventually, we never feel the size changings for our organismal body because of length contraction hypothesis.

3- The all factors support the each other for resistance: When the length of the cable increases by applying a pulling force the section area can be decreased; but, both status causes to increase the resistance value (a). This property is useful for some events e.g. for tracing the landslides (electrical resistivity tomography: ERT [2]).

4- If we consider an axial pressure for cable because of length contraction, the section area would increase and this effect would cause smaller value of resistance. So, it cannot be claimed that the length contraction is a reality and the value of resistance does not change because of pressure.

5- Precision gradient (resolution) of our digital ohmmeter was 1 Ω. This quality was tested by using a smaller cable (e.g. L = 448 m; instead of 450 m) and it was read R = 250 Ω.

6- In this experiment the resistance value was measured 251 Ω > theoretical value 244 Ω. Does this positive difference indicate an opposite hypothesis of length contraction? Probably, the measurement errors (systematic or humanly) are mentioned or because of accessory of the experiment (experiment conditions were standardized).

7- Maximum value of the Earth's universal velocity: The Earth turns around the Sun by the speed ~30 km/sec. Solar system has a speed in Milky way galaxy ~250 km/sec… our local group has a speed ~0.60 c (expanding velocity of universe) according to space or LCS (Light Coordinate System) This value was indicated by elaborately cosmological analysis [3]. Eventually, when we consider the radius and age of universe we may guess that the expansion speed of formations must be high. We can consider the value of 60% c for the maximum universal velocity of the Earth (the other vectoral components of orbital speeds were ignored). The max. speed of test object will get the value "0.60 c".

According to Lorentz equation: for v = 0.60 c

$$L' = L\,(1 - v^2/c^2)^{1/2} = 0.80\ L \qquad (b)$$

And if length contraction hypothesis is valid; we would read the value of the resistance as 195 Ω for one of all directions; but, the ohmmeters always indicated 251 Ω.

Besides, nobody feels his body's size vary up to 20 %, like vibration or shaking.

8- The resolution of ohmmeters (1 Ω) requires 1.84 m contraction; and 1.84 m accounts for v = 0.09c. Minimum effective speeds are already zero for the arms on perpendicular position of test apparatus according to traveling direction. We may

consider that his experiment had been realized for the universal speeds of the Earth interval $V_U = 0 – 0.60$ c.

CONCLUSION

The measured values had been always read just 251 Ω for all directions; this result has high significance (It is not necessary to know the earth's universal velocity).

Fitzgerald contraction was a cleverly prophecy to revive the aether hypothesis. Maxwell's definition already indicated that the light never be in need of physical medium to radiate.

This electrical resistance based experiment did not indicate an evidence for the length contraction.

References

[1] Trouton F. T., Rankine A.: On the electrical resistance of moving matter. In: Proc. Roy. Soc.. 80, Nr. 420, 1908. doi:10.1098/rspa.1908.0037.

[2] https://geomorphologie.revues.org/10474

[3] Ersan, Ö., Ersan I, Light kinematics to analyze space time, Physics Essays **26.1**, 49, 2013 [http://dx.doi.org/10.4006/0836-1398-26.1.49]