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Electric Current

(Cable Telegraphy and Wireless Telegraphy)

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Abstract. **Poynting's theorem applies to wireless telegraphy as well as to electric circuits and cable telegraphy. We will therefore seek to establish the commonality between these three phenomena.**

Electricity

I. Consider a closed circulation of electricity, irrespective of what the physical nature of electricity actually is. If we inject more electrical energy into the system, the circulation may either dilate or angularly accelerate, depending on the constraints. The difference between the dilating scenario and the angularly accelerating scenario represents the fundamental difference between *'cable telegraphy'* and *'wireless telegraphy'*, both of which ultimately constitute *'electric current'*.

Cable Telegraphy

II. Cable telegraphy is based on the dilating circulation of electricity that is guided between two conducting wires in the moments immediately after the power source is attached. During the dynamic state, the return limb may even be static like a caterpillar track on the ground. The circulation is completed across the gap at an advancing single step wave which has an associated transverse electric field. The circulation is surrounded by a magnetic field as per Ampère's circuital law. Particles don't cross the gap at the step, and so the first thing that we need to do is rule out the conventional theory that electric current is a flow of charged particles. We need to re-introduce the old vitreous fluid of Franklin, Watson, and DuFay. At the step, the transverse flow of this aethereal fluid causes a linear polarization of the dielectric material which in turn induces a back EMF that impedes the circulation and causes the circulation to expand and go wide of the charged zone. The advancing

step in the space between the wires bears many similarities to electromagnetic radiation. There is an electric field **E** that is coupled to a perpendicular magnetic field **H**, both of which are mutually transverse to the direction of propagation. The electric and magnetic fields at the step are in the dynamic state, the *'displacement current'* factor $\partial\mathbf{E}/\partial t$ is non-zero, and the associated wave travels at a very high speed. There are however important differences between cable telegraphy and wireless telegraphy. Since the displacement current in the case of cable telegraphy is due to linear polarization in the dielectric, and hence the changing part of the electric field is associated with Gauss's law and not with the induced electric field of time varying electromagnetic induction, we cannot therefore use the linear displacement current in cable telegraphy in order to derive the electromagnetic wave equation. This means that the speed of a transmission line pulse cannot be theoretically calculated.

Wireless Telegraphy

III. Wireless telegraphy comes under the jurisdiction of Maxwell's electromagnetic wave equation. There are no wires involved. The electromagnetic wave involves a displacement and an associated displacement current, denoted mathematically by $\partial\mathbf{E}/\partial t$, in which the **E** is the induced **E** arising from electromagnetic induction in a time varying magnetic field. The divergence of $\partial\mathbf{E}/\partial t$ is zero and so we conclude that the **E** vector must be transversely directed in a radial field. In order to reconcile this fact with electromagnetic radiation that exists deep in space, we need to have an electric circuit at every point in space where electromagnetic radiation exists. We therefore require that space constitutes a sea of densely packed tiny electric circulations that are pressing against each other with centrifugal force while striving to dilate. The displacement current in wireless telegraphy must therefore be transverse within these tiny electric circulations, and so it must be an *'angular displacement current'* that causes a propagation of angular acceleration between the neighbouring miniature electric circulations that fill all of space.

The Sea of Tiny Electric Currents

IV. In the eighteenth century, the younger John Bernoulli (1710-1790) was well ahead of his time. E.T. Whittaker says **[1]**,

"All space, according to the younger Bernoulli, is permeated by a fluid aether, containing an immense number of excessively small whirlpools. The elasticity which the aether appears to possess, and in virtue of which it is able to transmit vibrations, is really due to the presence of these whirlpools ; for, owing to centrifugal force, each whirlpool is continually striving to dilate, and so presses against the neighbouring whirlpools. It will be seen that Bernoulli is a thorough Cartesian in spirit ; not only does he reject action at a distance, but he insists that even the elasticity of his aether shall be explicable in terms of matter and motion. This aggregate of small vortices, or " fine-grained turbulent motion," as it came to be called a century and a half later, is interspersed with solid corpuscles, whose dimensions are small compared with their distances apart. These are pushed about by the whirlpools whenever the aether is disturbed, but never travel far from their original positions. A source of light communicates to its surroundings a disturbance which condenses the nearest whirlpools ; these by their condensation displace the contiguous corpuscles from their equilibrium position ; and these in turn produce condensations in the whirlpools next beyond them, so that vibrations are propagated in every direction from the luminous point. It is curious that Bernoulli speaks of these vibrations as longitudinal, and actually contrasts them with those of a stretched cord, which, "when it is slightly displaced from its rectilinear form, and then let go, performs transverse vibrations in a direction at right angles to the direction of the cord." When it is remembered that the objection to longitudinal vibrations, on the score of polarization, had already been clearly stated by Newton, and that Bernoulli's aether closely resembles that which Maxwell invented in 1861-2 [2] for the express purpose of securing transversality of vibration, one feels that perhaps no man ever so narrowly missed a great discovery. Bernoulli explained refraction by combining these ideas with those of his father. Within the pores of ponderable bodies the whirlpools are compressed, so the centrifugal force must vary in intensity from one medium to another. Thus a corpuscle situated in the interface between two media is acted on by a greater elastic force from one medium than from the other; and by applying the triangle of forces to find the- conditions of its equilibrium, the law of Snell and Descartes may be obtained.*
** Cf . Lord Kelvin's vortex-sponge aether, described later in this work."*

Conclusion

V. It would seem that the younger John Bernoulli's view that electromagnetic radiation is a longitudinal phenomenon, follows from the fact that we are dealing with a longitudinal propagation of fine-grained centrifugal pressure **[3]**, **[4]**. The oscillating electric and magnetic fields will however still be orientated transversely to the direction of propagation, and this explains why we can have plane polarization. Wireless telegraphy involves a dense sea of tiny electric circulations that fill all of space, and these are constrained from dilating due to mutual centrifugal force. Wireless telegraphy is therefore the propagation of pure centrifugal pressure through a sea of tiny electric circuits, due to angular acceleration, with electric current being the circulation of pressurized vitreous fluid. Wireless telegraphy and time varying electromagnetic induction are essentially one and the same thing, the only difference being that we normally associate the latter with large scale electric circuits. Both cases relate to the overspill of electrical energy to a secondary neighbouring circuit when the energy in the primary circuit is constrained to angularly accelerate. Cable telegraphy on the other hand is about the motion of a single expanding circulation of electricity, guided between two conducting wires, while the enclosed region is being inflated with static charge in the form of linear polarization. There is no time varying electromagnetic induction involved in cable telegraphy since we are only dealing with one circuit. Cable telegraphy does not therefore come under the jurisdiction of Maxwell's electromagnetic wave equation as this wave equation is based on electromagnetic induction. Electric charge is pressurized vitreous fluid which is pumped into an electric circuit from the power source, causing the electric circulation to either dilate or angularly accelerate. An electric current therefore behaves according to the hydrodynamical rules of *'Bernoulli's Principle'** in tandem with wave mechanics. Voltage and charge are essentially the same thing and they both represent pressure, while electric current is kinetic energy.

**Bernoulli's Principle was conceived by Daniel Bernoulli (1700-1782), who was the elder brother of the John Bernoulli already mentioned.*

References

[1] Whittaker, E.T., ***"A History of the Theories of Aether and Electricity"***, Chapter 4, pages 100-102, (1910)

[2] Clerk-Maxwell, J., ***"On Physical Lines of Force"***, Philosophical Magazine, Volume XXI, Fourth Series, London, (1861)
http://vacuum-physics.com/Maxwell/maxwell_oplf.pdf

[3] Tombe, F.D., ***"The Double Helix Theory of the Magnetic Field"***
https://www.researchgate.net/publication/319914395_The_Double_Helix_and_the_Electron-Positron_Aether
https://www.researchgate.net/publication/295010637_The_Double_Helix_Theory_of_the_Magnetic_Field

[4] *"Long ago he* (mankind) *recognized that all perceptible matter comes from a primary substance, or tenuity beyond conception, filling all space, the Akasha or luminiferous ether, acted upon by the life giving Prana or creative force, calling into existence, in never ending cycles all things and phenomena. The primary substance, thrown into infinitesimal whirls of prodigious velocity, becomes gross matter; the force subsiding, the motion ceases and matter disappears, reverting to the primary substance."(PRODIGAL GENIUS, Biography of Nikola Tesla, by John J. O'Neill , Freeport, Long Island, New York, 15th July 1944)*

The 1937 Encyclopaedia Britannica article on 'Ether' discusses the speed of light in relation to the structure of the ether. It says, "*POSSIBLE STRUCTURE.__ The question arises as to what that velocity can be due to. The most probable surmise or guess at present is that the ether is a perfectly incompressible continuous fluid, in a state of fine-grained vortex motion, circulating with that same enormous speed. For it has been partly, though as yet incompletely, shown that such a vortex fluid would transmit waves of the same general nature as light waves _i.e., periodic disturbances across the line of propagation_ and would transmit them at a rate of the order of magnitude as the vortex or circulation speed - - - -*"

It was not made clear from the article whether or not they were referring to Tesla's theory. At any rate, contrary to what it says, the aether is almost certainly compressible and stretchable.