Centrifugal Force in the Electric Circuit

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Abstract. The Lorentz force contains a convective term, v×H. It has been assumed in this series that this term is a Coriolis force. It was shown in an earlier paper that the centrifugal force, grad(A.v), should also be present in the Lorentz force but that it is missing.

It will now be suggested that the v×H term in the Lorentz force may in fact be the general convective force, and that it refers to the centrifugal force in the irrotational case when it applies to the force that is acting on a current carrying wire, whereas it refers to the Coriolis force in the rotational case when an electric current is induced in a wire that is moving through a magnetic field.

The Complete Lorentz Force

I. In section **III** of 'Gravitation and the Gyroscopic Force' at,

http://www.wbabin.net/science/tombe5.pdf

it was shown that the complete Lorentz force should take the form,

$$\mathbf{E} = \text{grad}\psi + \partial\mathbf{A}/\partial t_{\text{(angular acceleration)}} - \mathbf{v}\times\mathbf{H} + \text{grad}(\mathbf{A}.\mathbf{v}) \qquad \textbf{(1)}$$

and that this will include an extra centrifugal force term of the form grad(**A**.**v**). It was also discussed in 'The General Convective Force' at,

http://www.wbabin.net/science/tombe41.pdf

how the Coriolis force and the centrifugal force, from a mathematical perspective, are mutually perpendicular components of a single parent convective force of the form m**v**×**ω**, where **ω** is angular velocity and/or vorticity.

As such, we must now enquire as to whether the already well known term **v×H** that appears in the Lorentz force is in fact the general convective force covering for both the Coriolis and the centrifugal effects. Until now it has been assumed to be purely a Coriolis force.

Centrifugal Force

II. Centrifugal force exists in the natural state of affairs. Every straight line motion contains a radial centrifugal force with respect to a point that does not lie along the path of the motion. Centrifugal force is built into the geometry of space as a result of space being filled with tiny aethereal vortices. ET Whittaker writes *"All space, according to the young [John] 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."* **[1]**

These vortices are the very essence of centrifugal force. Centrifugal force is positive charge (aether outflow pressure) as regulated by the angular speed of these vortices, and by the mutual tangential speed between the particles of neighbouring vortices.

Consider a particle that is moving in a straight line and passing by a point origin **O**. At closest approach, its direction will be perpendicular to the radial line that joins the point **O** with the particle. As the particle continues onwards, the radial direction will continually rotate until it tends to be in the same direction as the direction of motion. The associated outward radial acceleration is centrifugal acceleration and it will take on the mathematical form $r\omega^2$ where **ω** is angular velocity. Centrifugal force is induced radially outwards on all tangential motion. It is a perpendicular induced effect with the same nature as electromagnetic induction. The link to electromagnetism can be seen by extrapolating centrifugal force to the situation which occurs in the four body problem as between two adjacent closed orbital systems. In particular we will consider the case of two adjacent electron-positron dipole orbits aligned in their mutual equatorial plane and each rotating in the same direction. The centrifugal force acting between the two electron-positron dipoles, due to the mutual circumferential speeds, will cause a mutual repulsion. This immediately leads us to suspect that aether pressure must be

involved in centrifugal force, and this is the basis upon which Maxwell explained the magnetic repulsion which exists laterally between Faraday's lines of force. Maxwell used the concept of tiny molecular vortices aligned solenoidally along their mutual rotation axes to explain the magnetic field. Electron-positron dipoles, in which the electrons act as aether sinks, and the positrons act as aether sources, will now be considered to be a more focused picture of Maxwell's molecular vortices.

In large bodies that are moving in translational motion, gravity will entrain an extended region of the electron-positron sea beyond the body itself. This entrained region shall be called the gravitosphere. Where two such gravitospheres meet in a state of relative motion, there will be aether vorticity generated between the electron-positron dipoles at the shear region. This will generate a cushion of excess centrifugal repulsion which will allow the two gravitospheres to hover over each other with minimal friction and to repel each other at right angles to their directions of motion. Large scale centrifugal force is induced at right angles to the direction of motion by a constant tangential speed as per the formula $\mathbf{F} = m\mathbf{v}\times\boldsymbol{\omega}$. But the constant tangential speed of the large object is actually causing a tangential force to act on the electron-positron dipoles. As such we can have centrifugal force induced on an object on the inside surface of a rotating cylinder, even though it is not apparent which other object the tangential motion is relative to.

We would also expect there to be an excess centrifugal pressure generated in front of the direction of motion of a large body, due to compression of the tiny vortices in its path. This effect has been identified in the tangential motion of a Keplerian orbit, but it is counteracted by an equal and opposite tangential gravitational force which hence leads to the conservation of angular momentum. See section **V** in 'The Cause of Coriolis Force' at,

http://www.wbabin.net/science/tombe55.pdf

Centrifugal force is totally denied in modern physics. It has been purged from many textbooks over the last fifty years, possibly because of its implications regarding absolute motion, and the associated threat which that would pose to Einstein's theories of relativity. Rotating frames of reference have been introduced into the topic like a hall of mirrors in order to confuse the issue. This has led to the erroneous belief that centrifugal force is something that only exists in a rotating frame of reference, and that as such, it is only fictitious. Many physicists have been fooled into believing that an observer has to actually be rotating

with the radial line in order to be able to observe the induced outward radial acceleration. This is the same as saying that we need to actually be rotating inside a centrifuge machine in order to see it operating. While trying to deny centrifugal force as a reality, modern physicists use various methods. The centrifugal force term which appears in the planetary orbital equation is often hidden inside a vector box called 'radial acceleration', and the name 'centrifugal force' is denied for the $mr\omega^2$ term inside that box. Another method of denial is to retreat into Cartesian coordinates in an attempt to obscure the existence of the polar coordinate $mr\omega^2$ force. It's like as if they believe that a real effect is going to disappear simply by using a different and more cumbersome language of description.

This denial of centrifugal force has a very negative effect on the credibility of Maxwell's original papers, because Maxwell depended heavily on the very real centrifugal pressure in his sea of molecular vortices in order to explain magnetic repulsion. Centrifugal force is in fact a very real outward radial expansion that can lead to pressure and potential energy, and the effect is utilized in many engineering devices.

Coriolis Force

III. The Coriolis force is the tangential deflection of a radial motion in relation to the presence of vorticity. It can be observed in whirlpools in water and in cyclones in the atmosphere where the radial fluid flow is continually being deflected in the tangential direction. Section **V** below will explain that it is also an important force in electromagnetism. In modern physics, the Coriolis force has lost its original meaning. Rotating frames of reference are introduced and the term Coriolis force is now wrongly applied to the fictitious tangential deflections which are superimposed on top of all motion as viewed from a rotating frame. In these scenarios, there is actually no Coriolis force involved, real or fictitious. There is an apparent circular motion superimposed on top of the already existing motion, but the apparent tangential deflections in these scenarios are not what Coriolis force is all about. The situation is further confused by the common identification of Coriolis force with the cyclonic effect of the Earth's rotation. Cyclones and whirlpools can exist without the Earth's rotation, and as already mentioned above, a real Coriolis force will be involved in deflecting the radial fluid flows tangentially. For large scale fluid phenomena, the Earth's rotation can however ensure that the rotational effect will be cyclonic.

The Force on a Current Carrying Wire

IV. Maxwell used the equation **F** = **v**×**H** to explain the force on a current carrying wire in conjunction with his sea of molecular vortices, which will be considered here to be the electric sea of rotating electron-positron dipoles. **H** refers to the circumferential speed and hence to the vorticity of the vortices. Maxwell considered the circumferential speed, and hence **H**, to be a measure of the magnetic intensity. In modern physics, **H** corresponds to the magnetic field strength. See the third and fourth terms on the right hand side of equation (5) on page 168 (page 8 of the pdf file) and pages 171/172 (page 12 of the pdf file) of Maxwell's 1861 paper 'On Physical Lines of Force' **[2]** at,

http://vacuum-physics.com/Maxwell/maxwell_oplf.pdf

Although the **v**×**H** term is nowadays heavily associated with the name of Lorentz, Maxwell's 1861 paper was written when Lorentz was still a young boy. Maxwell's explanation for **F** = **v**×**H** in this context is exclusively in terms of centrifugal force, as opposed to Coriolis force. Maxwell never mentions the Coriolis force by name. This may be partly due to the fact that the name 'Coriolis Force' didn't come into general usage until the early twentieth century.

A current carrying wire is surrounded by a solenoidal alignment of aether vortices (rotating electron-positron dipoles) which control the aether pressure inside the wire by centrifugal repulsion. This solenoidal alignment prevents the escape of the high pressure aether/vitreous fluid that is associated with the electric current in the wire. Maxwell argued that when a current carrying wire is placed at a certain orientation within a magnetic field, that superimposition of the current's own magnetic field will result in a greater centrifugal pressure at one side of the wire, which will then cause a net force to act at right angles to the direction of the current.

It would seem that in this situation, the **F** = **v**×**H** force is a centrifugal force with **H** referring to the angular velocity of the electron-positron dipoles that are pushing against the wire from the surrounding electric sea. (Note that Maxwell did not use the concept of charge q in his 1861 paper)

In actual fact, this situation only occurs when the force in question is an attractive force, in which case it will be supplemented by a Coulomb tension running along the axes of the double helix alignment of the

electron-positron dipoles which constitute the magnetic lines of force, and which connect directly between the two attracting objects, pulling them together as like with helical springs. See figure 1 below for a diagram of a single magnetic field line,

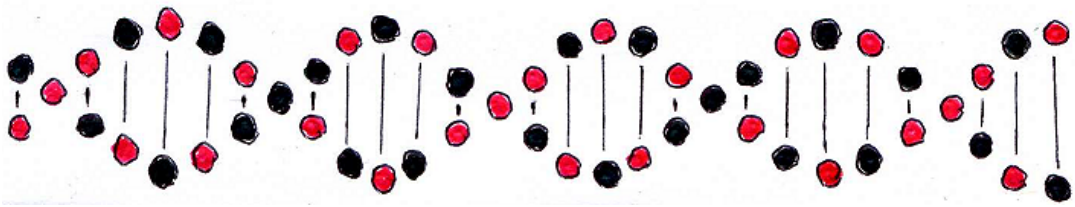

Figure 1. A close-up view of a single magnetic line of force. The electrons are shown in red and the positrons are shown in black. The double helix is rotating about its axis with a prodigious angular speed and the rotation axis represents the magnetic field vector H. The diagram is not to scale as the relative dimensions remain unknown.

In the case of a repulsive magnetic force, the centrifugal repulsion will occur laterally between the magnetic lines of force that are spreading outwards and away from each other in the region between the repelling objects.

The modern day application of $\mathbf{F} = q\mathbf{v}\times\mathbf{H}$ to the situation in which a force acts on a current carrying wire, gets the direction right, and it correctly covers for the fact that the magnitude of the force will increase with the magnitude of the current in the wire. But in modern physics, there is absolutely no comprehension whatsoever as regards the physical interpretation of the $\mathbf{v}\times\mathbf{H}$ term. Bar magnets require work to be done in order to oppose the associated forces of attraction and repulsion, yet the $\mathbf{v}\times\mathbf{H}$ force, within the limited understanding of its physical meaning, does not appear to cater for the necessary associated potential energy function.

Electromagnetic Induction

V. The $\mathbf{F} = \mathbf{v}\times\mathbf{H}$ force is also involved in electromagnetic induction. Maxwell introduced it again at equation (77) in the form $\mathbf{E} = \mathbf{v}\times\mathbf{H}$, where **E** refers to electromotive force. Once again, Maxwell never mentioned the Coriolis force by name.

Maxwell attempted to explain this convective aspect of electromagnetic induction in terms of a differential pressure on the vortices in front of a wire that is moving through his vortex sea, as compared to behind the wire where there should be a rarefaction in the sea. He assumed that this

pressure differential would result in different vorticities on opposite sides of the wire, with the resultant effect determining the direction of the current flow in the wire. See **Appendix B** for Maxwell's actual explanation.

It would seem as though we are dealing with a centrifugal barrier and the generation of centrifugal aether pressure. When the wire is moving in the equatorial plane of the magnetic field, the electron-positron dipoles will be flowing around the outside of the wire. The wire will be pushing against the equatorial planes of the electron-positron dipoles in front of its path of motion, hence causing the dipoles to contract. This will have the effect of generating aether pressure. Additional aether pressure over and above the already existing equilibrium value is generated in an electron-positron dipole either by tangential force or by forcing a contraction of the diameter for an existing tangential speed, which then results in tangential acceleration and increased vorticity. Both of these induction effects cause the congesting of the electron sinks, and the widening of the positron sources, hence leading to an increased aether pressure outflow (positive charge in the guise of magnetic charge). Both of these induction effects will be occurring as the wire moves through a magnetic field and work will have to be done to supply the force that is necessary to push the wire through the magnetic field. The differential pressures and vorticities in front of the wire as compared to behind the wire will cause the newly induced aether pressure to deflect by ninety degrees and to flow along the wire. This is where we get the equation $\mathbf{E} = \mathbf{v}\times\mathbf{H}$. It is clearly a Coriolis force that is acting in conjunction with a centrifugal force. This paints a picture of Coriolis force as being a sideways deflection from a centrifugal barrier. Hence, even though the Coriolis force in isolation doesn't involve any changes between kinetic energy and potential energy, the aspect of electromagnetic induction which involves the Coriolis $\mathbf{E} = \mathbf{v}\times\mathbf{H}$ force also involves the centrifugal force. Hence Lenz's Law is involved, since work is required to induce the initial centrifugal effect. The situation in principle is not unlike the time varying kind of electromagnetic induction. The $-\partial\mathbf{A}/\partial t$ force which appears in the Lorentz force to cater for time varying electromagnetic induction is an angular acceleration of the electron-positron dipoles which is driven by a $+\text{grad}(\mathbf{A}.\mathbf{v})$ centrifugal aether pressure. This propagated angular acceleration travels through the vortex sea to the wire in the form of electromagnetic radiation, bringing with it centrifugal aether pressure which then discharges tangentially into the wire. Induced aether pressure discharging into a wire is the common basis for both kinds of electromagnetic induction.

The convective aspect of electromagnetic induction gives us something of an insight into the nature of the Coriolis force. The Coriolis force appears to be a sideways deflection which occurs when an object moves in a vortex field. The situation with electromagnetic induction in a wire that moves in a magnetic field is quite complex. It involves the electron-positron dipoles moving around the two sides of the wire and joining together again at the other side. Precessional realignments will occur. Centrifugal force and centrifugal pressure will be involved. Aether will be generated due to both compressions and tangential shear stress. Work will be done, and the aether will be deflected by ninety degrees along the direction of the wire. The pressurized aether flow is what constitutes electric current. Electric current should normally drive electric particles along with it. In a closed conductor circuit the electric particles will move freely in translational motion, whereas in a dielectric or a broken conductor circuit, linear polarization will ensue.

Lenz's law caters for the work done against the centrifugal pressure that is generated in the magnetic field, as opposed to merely the work that would have been done in moving the wire in the absence of a magnetic field. Linear polarization also generates an opposing centrifugal pressure which is somewhat of an analogy to Lenz's law for capacitor circuits. See 'Electrostatic Repulsion and Aether Pressure' at,

http://www.wbabin.net/science/tombe44.pdf

Work Done

VI. In the Coriolis case, the velocity **v** will be totally independent of the vorticity **H**. As such, in a constant **H** field, no work will be done by the Coriolis force. It will merely act to change the direction of a particle, and hence kinetic energy will be conserved.

However, in the case of centrifugal force, the velocity **v** and the angular velocity **H** will be totally inter-connected. This means that we can have a potential energy term **A**.**v** which will allow for work to be done. Work is indeed done when magnetic force acts to cause objects to mutually attract or to mutually repel.

Appendix A (Terminologies)

VII. The electric sea, the electron-positron sea, the sea of tiny aethereal vortices, the sea of molecular vortices, and the luminiferous medium are all the same thing. The electric sea is a densely packed sea of rotating electron-positron dipoles that are aligned solenoidally along their mutual rotation axes in double helix fashion, hence giving rise to the magnetic field.

The aether is a deeper and more mysterious medium within which electrons constitute sinks and positrons constitute sources. The aether is dynamical, stretchable, and compressible and it constitutes space itself. The aether is not the medium for the propagation of light but it is the medium that is the cause of all the fundamental forces between particles.

Appendix B

(Maxwell on Motion Induced Electromagnetic Induction)

VIII. This is a quote from page 344 (page 33 of the pdf file) in Part II of Maxwell's 1861 paper 'On Physical Lines of Force' **[2]**, regarding his explanation of electromagnetic induction as is induced in a wire that is moving in a magnetic field;

"In front of the wire, that is, on its east side, it will be seen that as the wire approaches each portion of the medium, that portion is more and more compressed in the direction from east to west, and extended in the direction from north to south; and since the axes of the vortices lie in the north and south direction, their velocity will continually tend to increase by Prop. X., unless prevented or checked by electromotive forces acting on the circumference of each vortex.

We shall consider an electromotive force as positive when the vortices tend to move the interjacent particles upwards perpendicularly to the plane of the paper.

The vortices appear to revolve as the hands of a watch when we look at them from south to north; so that each vortex moves upwards on its west side and downwards on its east side. In front of the wire, therefore, where each vortex is striving to increase its velocity, the electromotive force must be greater on its west than on its east side. There will therefore be a continual increase of electromotive force from the remote east, where it is zero, to the front of the moving wire, where the upward force will be strongest.

Behind the wire a different action takes place. As the wire moves away from each successive portion of the medium, that portion is extended from east to west, and compressed from north to south, so as to tend to diminish the velocity of the vortices, and therefore to make the upward electromotive force greater on the east than on the west side of each vortex. The upward electromotive force will therefore increase continually from the remote west, where it is zero, to the back of the moving wire, where it is strongest.

It appears, therefore, that a vertical wire moving eastward will experience an electromotive force tending to produce in it an upward current." James Clerk-Maxwell 1861.

References

[1] ET Whittaker, A History of the Theories of Aether and Electricity; The Classical Theories (London; New York, American Institute of Physics, 1987) p.6

[2] Clerk-Maxwell, J., "On Physical Lines of Force", Philosophical Magazine, Volume 21, (1861)