The Faraday Paradox and Newton's Rotating Bucket

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Abstract. Inertia is generally understood to be that tendency of a body to continue in its state of uniform motion unless acted upon by an external force.

This is a very limited Cartesian way of looking at the situation. The general situation can be understood within the context of centrifugal force. Inertia is centrifugal force in irrotational fields.

Centrifugal force in turn is one mutually perpendicular aspect of a more general convective force of the form vXω which acts in magnetic fields and in the cyclonic phenomena in the oceans and the atmosphere. In general therefore, inertia is vXω where ω is the angular velocity of the aether at the point in question and v is the linear velocity of the particle or fluid element.

Centrifugal Force

I. Centrifugal force is one of four aethereal based forces of which the other three are combined together into the Lorentz force. The Lorentz force was derived by Maxwell at equation (77) in his 1861 paper 'On Physical Lines of Force' [1] when Lorentz was still a young boy. Although Maxwell didn't include centrifugal force in equation (77) he nevertheless used the concept to account for the force of repulsion between Faraday's magnetic lines of force. In section **III** of 'Gravitation and the Gyroscopic Force' at,

it was shown how equation (58) in Maxwell's 1861 paper can be used to derive a form of the Lorentz force that includes centrifugal force. The term for centrifugal force is +grad(**A**.**v**) where **A** is aether field velocity. Since **A**.**v** is a scalar product of two vectors, it means that centrifugal force is a convective effect which occurs when a particle cuts across aether flow. More simply it can be considered as the mutually repulsive acceleration that occurs between any two particles as a result of their mutual tangential speed. It is the force that keeps the Moon from falling to the Earth.

Since angularly accelerating aether is most unlikely to be a naturally occurring phenomenon on any scale, Maxwell's 1861 paper would tend to suggest that the $\partial\mathbf{A}/\partial t$ term in the Lorentz force must ultimately be due to a convective force. Equation (5) in Maxwell's 1861 paper is a similar equation to equation (77). It was derived hydrodynamically and it would appear that the $\partial\mathbf{A}/\partial t$ term of equation (77) is covered for in equation (5) by either a centrifugal force, a Coriolis force, or both. The second term on the right hand side of equation (5) is clearly a centrifugal force, and the third and fourth terms are clearly Coriolis force terms.

Planetary Orbital Theory and Inertia

II. If we have an ellipse whose coordinates are polar and centred on the focus, and we differentiate it with respect to time, we obtain two distinct radial forces. We obtain an attractive inverse square law force and a repulsive centrifugal force working together in tandem.

The general solution for these two forces working together in tandem is a conic section. If the eccentricity is less than unity, we will have an ellipse. If the eccentricity is equal to unity we will have a parabola, and if the eccentricity is greater than unity we will have a hyperbola.

In the extreme case of the inverse square law vanishing, we will obtain a hyperbola of infinite eccentricity. This infinitely eccentric hyperbola is in fact the straight line motion that we witness in everyday Cartesian life and attribute to inertia.

Centrifugal force is all around us but we don't notice it because we generally don't pay any attention to the radial vector between objects. We

tend to look at the relative motion of objects with respect to our local Cartesian coordinate frame.

This common observational omission has led to suggestions that centrifugal force does not exist since it can be written off as inertia.

Inertia is however a very archaic concept which is of no use to us when we are dealing with matters on the microscopic and astronomical scales where centrifugal force becomes manifestly very real.

Rotating Frames of Reference

III. It is taught nowadays that centrifugal force is only a fictitious force that exists when we view a situation from a rotating frame of reference.

If a weight is swung in circular motion on the end of a string and released, it will fly off both radially and tangentially. When asked which direction the weight will fly off in, the educated person is expected to answer ‘tangentially’ and ignore the outward radial acceleration. Only the fool is expected to draw attention to the outward radial acceleration.

However, when we move into the centrifuge machine which masks the tangential motion that causes the radial acceleration, it then becomes legitimate to recognize the radial centrifugal force which brings about the desired physical centrifuge effect. Nevertheless this real effect is still written off as being purely fictitious.

It is also argued that in the Cartesian inertial frame that circular motion is brought about purely by inward acting centripetal force and that there is no need to contemplate the issue of centrifugal force. A simple vector triangle of velocity vectors on the arc of a circle can illustrate that the centripetal force acts radially inwards and that it is the only force acting in the system.

However, as stated above, centrifugal force is inertia. Inertia means straight line motion. The centripetal force that causes motion in a circle as viewed from the Cartesian inertial frame is acting on the straight line motion that is already the result of centrifugal force.

If we consider the vector triangle again but this time for a straight line motion that is referenced with respect to the same origin, we will obtain a

radially outward acting force with the same mathematical formula. Even for the straight line, the velocity vector will have changed its direction in relation to the radial vector.

Centrifugal force is clearly implicit in inertia.

The Parent Convective Force

IV. Centrifugal force is real. In actual fact, centrifugal force is only the radial component of a more general parent convective force **v**X**ω**. In polar coordinates the parent convective force **v**X**ω** splits into two mutually perpendicular components. The centrifugal force will be an outward radial deflection acting on tangential motion, and the Coriolis force will be a tangential component acting on radial motion.

This parent convective force requires an actual aethereal medium in order to have any meaning because the effect is caused by an actual cutting across aether flow. It is essentially the fundamental aethereal hydrodynamical convective force which manifests itself in the solenoidally aligned electric sea as the magnetic **v**X**B** force. It also manifests itself in the cyclonic behaviour in both the oceans and the atmosphere, both on the microscopic inter-particle scale and on the large scale in connection with the Earth's rotation.

The derivation of this parent convective force involves a vector triangle which implies that the Coriolis force occurs when the radial velocity of the object, or fluid element, is physically connected to the larger rotating body. The derivation ensures that the angular velocity term **ω** is physically connected with the tangential component of the velocity of that particle or fluid element.

This state of affairs occurs in the pure aether as well as in the oceans and the atmosphere, because any radially moving elements of aether or fluid will be moving relative to the larger body of rotating fluid to which they are bonded.

It is a common mistake to believe that the Coriolis force can be applied to apparent deflections of disconnected objects that are viewed from a rotating frame of reference. In this kind of situation, the deflections are only observed from the rotating reference frame and are entirely fictitious.

In hydrodynamics, the Coriolis force is a real effect which can be viewed from any reference frame. We can see the cyclones from outer space.

The Faraday Paradox and the Bucket Argument

V. When a charged particle moves tangentially in the equatorial plane of a magnetic field, it will experience the convective **v**X**B** force. However, when the particle is stationary and the magnet rotates on its magnetic axis, no such force will be induced. Nobody has ever suggested that if we view the situation from the frame of reference of the rotating magnet that we will see an artificial circle being traced out. This would be a fictitious effect of no significance.

If we rotate a bucket of water we obtain a hydrostatic pressure which is caused by the convective **v**X**ω** force. This differs in geometry from the magnetic situation above due to the fact that in the magnetic scenario, the convective **v**X**B** force is being induced through a sea of tiny aether vortices. As such, in the magnetic scenario, the **v**X**B** force acts tangentially whereas in the spinning bucket of water scenario, the **v**X**ω** force is centrifugal and acts radially outwards.

Once again, there would be absolutely no significance in viewing a stationary object from a rotating frame of reference. But there is a school of thought nowadays that attaches great significance to the artificial circle that is traced out when a stationary object is viewed from a rotating frame of reference.

Whatever this artificial effect is, it is not **v**X**ω** as some people seem to believe. In order for the centrifugal force to act on an object, it must be in an actual state of tangential motion with respect to some point. That means that in rotating frames of reference such as in a centrifuge device, the object in question must be co-rotating.

References

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

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