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Bernoulli's Principle and the Theory of Flight

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Abstract. **When an aeroplane moves horizontally through the air, the air pressure below the wings is greater than the air pressure above the wings. This causes a force to act vertically upwards on the aeroplane, at right angles to its direction of motion. Likewise, when an electric current flows through a wire in a magnetic field, a differential pressure is exerted on either side of the wire, causing a force to act at right angles to the wire. The commonality between these two phenomena will now be investigated.**

The Venturi Effect

I. The *Venturi Effect* arises when a fluid is forced to flow through a constriction. The counterintuitive consequence that follows may give us some insight into the nature of the inter-particle forces that comprise the fluid. Based on the kinetic theory of gases, we might expect a state of congestion to occur at the constriction, but in fact the complete opposite happens. Instead, the fluid accelerates through the constriction, resulting in a decrease in both its pressure and its density. The fact that this is fully in line with Bernoulli's principle doesn't actually explain why it happens. Bernoulli's principle is simply a statement of energy conservation, and we would expect energy to be conserved even if the constriction had caused congestion. The initial conclusion would therefore be that the particles of the fluid exert a repulsive force on each other, and that when the flow-channel narrows as the particles approach the constriction, they are pushed from the sides by their neighbours and accelerated through the narrow gap.

The Theory of Flight

II. The aerofoil section that is characteristic of the wings of an aeroplane, is shaped in such a way that there is a camber on the upper side. Hence, when a wing moves through the air horizontally, the camber opens up a greater volume of space above the wings for the air to expand into. The repulsive force acting between the air molecules that is speculated in section **I** above, will then push these molecules further apart, and in doing so, the air pressure will reduce as potential energy is converted into kinetic energy. The air pressure below the wings will then be greater than the air pressure above them, and so an upward vertical force acts on the wings at right-angles to their direction of motion. Just as in the case of the Venturi effect, this is fully in line with Bernoulli's principle, although the two phenomena are not the same at all. In the case of the Venturi effect, a fluid is forced into a narrower space, whereas in the case of the aerofoil section, a fluid is allowed to expand naturally into a larger space. Meanwhile, in neither case, does Bernoulli's principle actually explain the cause of what occurs.

The Force on a Current Carrying Wire in a Magnetic Field

III. On page 172 in Part I of his 1861 paper, ***"On Physical Lines of Force"***, **[1]**, James Clerk Maxwell explained the force that acts on a current carrying wire in a magnetic field in terms of a differential centrifugal pressure acting on either side of the wire. The centrifugal pressure in question arises in the equatorial planes of the tiny aethereal vortices which he believed filled all of space. Maxwell explained that these vortices mutually align along their rotation axes which then trace out solenoidal magnetic lines of force around their source electric current. When a secondary current carrying wire moves at right angles through an already existing magnetic field, the relative speed to the circulating aether in the circumference of the all-pervading tiny vortices, will be different on either side of the wire, and this will induce a net force to act on it at right-angles to its direction of motion. Meanwhile, it is proposed that Maxwell's vortices were in fact rotating electron-positron dipoles, **[2]**.

Conclusion

III. In the case of the Venturi effect, as the fluid approaches the constriction, sideways pressure causes the fluid to accelerate through the narrow gap. Note that this acceleration is at right-angles to the sideways pressure that causes it. Admittedly there will be momentum coming from behind too, but this could in theory all simply lead to congestion. The fact that, instead, the fluid accelerates and rarefies, along with the fact that the acceleration is at right angles to the causative pressure, indicates that fine-grained gyroscopics might be at play. The pressure with which the fluid particles press against each other therefore might be a centrifugal pressure associated with the particles striving to dilate. If this is so, then we can more clearly see the commonality between the theory of flight and the force on a current carrying wire in a magnetic field. In both cases, there is a differential centrifugal pressure acting on either side of the wing or the wire, as the case may be.

References

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

[2] Tombe, F.D., ***"The Double Helix Theory of the Magnetic Field"***, (2006) Galilean Electrodynamics, vol. 24, Number 2, p.34, (March/April 2013)
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