Corrected law and Perpendicular action experiment

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In my Lorentz perpendicular action experiment, (see **Lorentz perpendicular action experiment and Lorentz force law,** blogspot academia) the movement of a test coil proved experimentally that the magnetic force on it does not verify the Lorentz force law and in consequence, showed a flaw of the law.

In this experiment, the magnetic field of a magnet exerts a force on the test coil and makes it turn (see Figure 1). According to the Lorentz force law, the test coil should turn about the axle whether it is parallel to x-axis or y-axis. But the experiment showed that it does not turn when the axle is parallel to y-axis.

In the following, I will explain the experimental result using the corrected law of magnetic force that I proposed in **Correct differential magnetic force law,** blogspot acdgemia, and show that this law describes well the movement of the test coil.

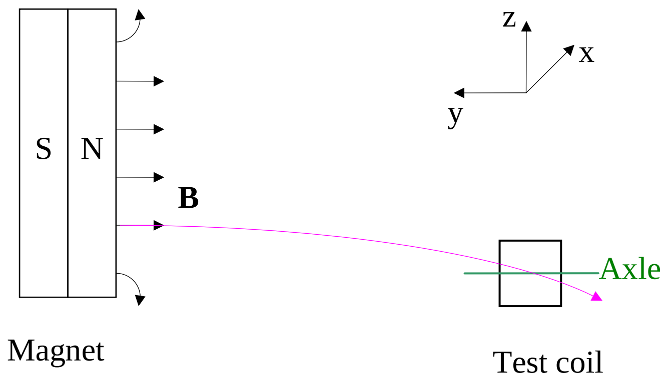

Figure 1

The corrected law expresses the differential magnetic force between 2 current elements d$\mathbf{I}_1$ and d$\mathbf{I}_2$ as follow (see Figure 2):

$$d^2\mathbf{F} = -\frac{\mu_0}{4\pi}\frac{\mathbf{r}}{r^3}\left(d\mathbf{I}_2 \bullet d\mathbf{I}_1\right) \qquad (1)$$

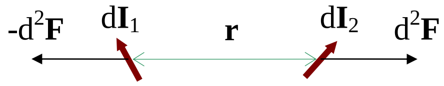

Figure 2

For this law, the magnetic force is proportional to the scalar product of the 2 current vectors and lies along the radial vector **r** joining the 2 elements. In the experiment, a magnet is used to produce the magnetic field. In order to compute the magnetic force of this setup using the corrected law, we replace the magnet with an equivalent current loop that produces the same magnetic field, ABCD in Figure 2, such that the magnetic force on the test coil, abcd in Figure 2, can be computed with equation (1).

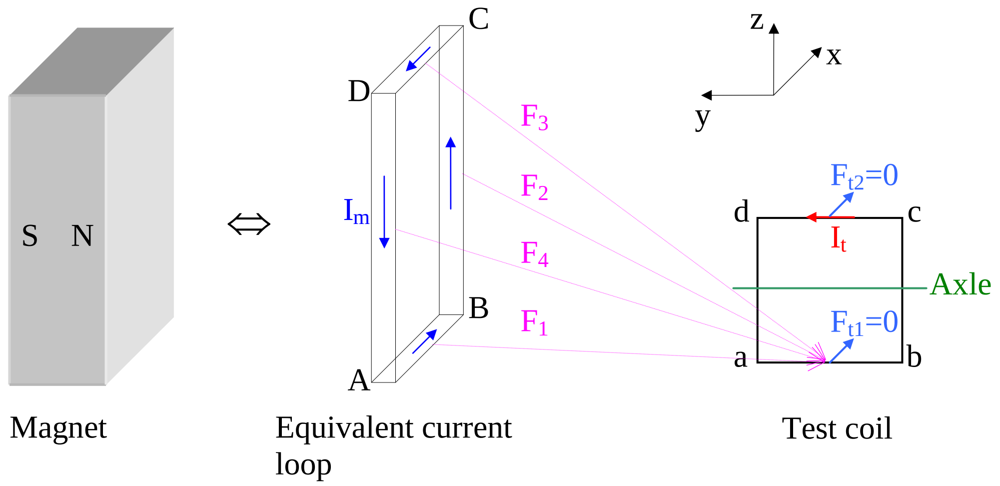

Figure 3

1. Case 1: Axle parallel to y-axis

The test coil would turn only when a torque is exerted about the axle, which is due to the x-component of the forces on the segment ab, bc, cd and da (see Figure 3 and Figure 4). In this section, I will compute the forces on these segments and the torque they create and then, prove that the torque is zero.

1.1. Forces on the segments ab and cd

As Figure 3 shows, the equivalent current loop is composed of 4 segments, AB, BC, CD and DA. The force on the segment ab is the sum of the forces exerted by these segments, respectively denoted by $\mathbf{F}_1$, $\mathbf{F}_2$, $\mathbf{F}_3$ and $\mathbf{F}_4$. As the magnetic force is proportional to the scalar product of the 2 interacting current vectors, and AB, BC, CD and DA are all perpendicular to ab, the 4 forces are all zero. In consequence, the resultant force on ab is zero:

$$d\mathbf{I}_m \cdot d\mathbf{I}_t = 0 \Rightarrow \mathbf{F}_1 = \mathbf{F}_2 = \mathbf{F}_3 = \mathbf{F}_4 = 0$$

$$\Rightarrow \mathbf{F}_{t1} = \mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3 + \mathbf{F}_4 = 0$$

where the index *m* indicates the equivalent current loop and *t* the test coil.

In the same way for the segment cd, AB, BC, CD and DA are perpendicular to cd and the force on it is zero too:

$$\mathbf{F}_{t2} = 0$$

1.2. Forces on the segments ad and bc

As Figure 4 shows, the axle cuts the segment ad at g. The force on the half-segment dg, $\mathbf{F}_{t3}$, is the sum of the forces from AB, BC, CD and DA, which are denoted by $\mathbf{F}_1$, $\mathbf{F}_2$, $\mathbf{F}_3$ and $\mathbf{F}_4$:

$$\mathbf{F}_{t3} = \mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3 + \mathbf{F}_4$$

AB and CD are perpendicular to dg and then, the forces $\mathbf{F}_1$ and $\mathbf{F}_3$ are zero:

$$d\mathbf{I}_m \cdot d\mathbf{I}_t = 0 \Rightarrow \mathbf{F}_1 = \mathbf{F}_3 = 0 \qquad (2)$$

BC and DA are parallel to dg and their forces on dg are not zero:

$$\mathbf{F}_{t3} = \mathbf{F}_2 + \mathbf{F}_4$$

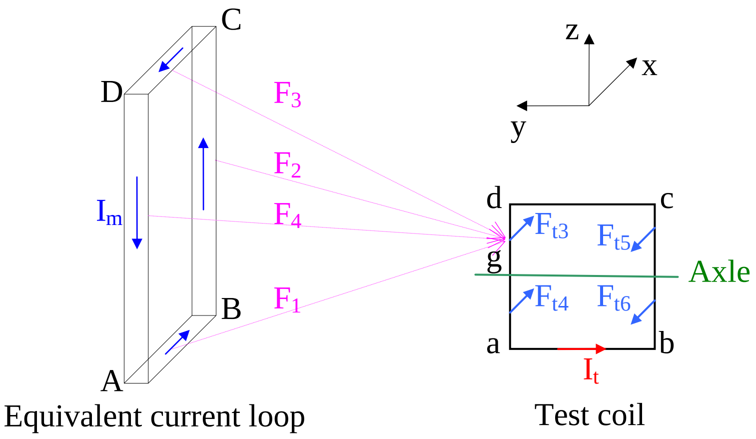

Figure 4

Below the axle, the force on the half segment ga is $\mathbf{F}_{t4}$ which is similar to $\mathbf{F}_{t3}$. The test coil is small and $\mathbf{F}_{t4}$ has approximately the same value than $\mathbf{F}_{t3}$:

$$\mathbf{F}_{t3} = \mathbf{F}_{t4} \tag{3}$$

On the segment bc, the forces on the upper and lower half-segments are $\mathbf{F}_{t5}$ and $\mathbf{F}_{t6}$, and they have approximately the same value too:

$$\mathbf{F}_{t5} = \mathbf{F}_{t6} \tag{4}$$

1.3. Torque about y-axis

The axle being parallel to y-axis, the torque of a force is the product of the x-component of the force with its lever arm. The x-components of the force vectors $\mathbf{F}_{t1}$, $\mathbf{F}_{t2}$, $\mathbf{F}_{t3}$, $\mathbf{F}_{t4}$, $\mathbf{F}_{t5}$ and $\mathbf{F}_{t6}$ are denoted respectively by:

$$F_{t1},\ F_{t2},\ F_{t3},\ F_{t4},\ F_{t5},\ F_{t6}$$

The lever arms of these forces are denoted respectively by l_1, l_2, l_3, l_4, l_5, l_6

The total torque about y-axis is the sum of the torques of these 6 forces and is:

$$\tau_y = l_1 F_{t1} + l_2 F_{t2} + l_3 F_{t3} + l_4 F_{t4} + l_5 F_{t5} + l_6 F_{t6}$$

According to equations (2), (3) and (4):

$$F_{t1}=0\ ,\quad F_{t2}=0\ ,\quad F_{t3} = F_{t4}\ ,\quad F_{t5} = F_{t6}$$

The torque becomes:

$$\tau_y = (l_3 + l_4)\, F_{t3} + (l_5 + l_6)\, F_{t5}$$

Because F_{t3} and F_{t5} are on upper half-segments and F_{t4} and F_{t6} are on the corresponding lower half-segments, their lever arms are opposed, that is:

$$l_3 = -\,l_4 \Rightarrow l_3 + l_4 = 0$$
$$l_5 = -\,l_6 \Rightarrow l_5 + l_6 = 0$$

Then we have:

$$\tau_y = 0 \tag{5}$$

So, the corrected law predicts zero torque for this case and the test coil will not turn about y-axis. This prediction fits the experimental result.

2. Case 2: Axle parallel to x-axis

The test coil is parallel to the equivalent current loop (see Figure 5). About x-axis, the torque is due to the y-component of the forces on the segment ab, bc, cd and da (see Figure 5 and Figure 6). In this section, I will show that these forces create the torque that makes the test coil turn.

2.1. Forces on the segments ab and cd

The force on the segment ab is the sum of the force exerted by AB, BC, CD and DA, denoted respectively by $\mathbf{F}_1$, $\mathbf{F}_2$, $\mathbf{F}_3$ and $\mathbf{F}_4$. BC and DA are perpendicular to ab and the forces they exert are zero:

$$d\mathbf{I}_m \cdot d\mathbf{I}_t = 0 \Rightarrow \mathbf{F}_2 = 0,\ \mathbf{F}_4 = 0$$

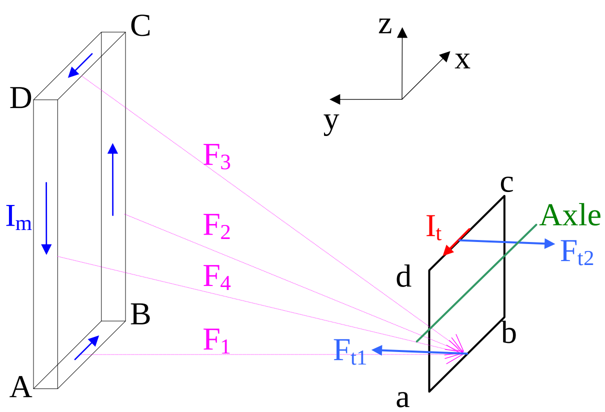

Figure 5

The segment AB is parallel to ab, the force $\mathbf{F}_1$ is computed using equation (1):

$$\mathbf{F}_1 = -\frac{\mu_0 I_m I_t}{4\pi} \int_{AB} \int_{ab} \left(\frac{\mathbf{r}}{r^3} dl_m dl_t \right) \tag{6}$$

The force from the segment CD is computed in the same way, its expression is the above equation with the domain of integration changed from AB to CD:

$$\mathbf{F}_3 = -\frac{\mu_0 I_m I_t}{4\pi} \int_{CD} \int_{ab} \left(\frac{\mathbf{r}}{r^3} dl_m dl_t \right) \tag{7}$$

And the resultant force on the segment ab is the sum of the above 2 integrals:

$$\mathbf{F}_{t1} = \mathbf{F}_1 + \mathbf{F}_3 = -\frac{\mu_0 I_m I_t}{4\pi} \int_{AB+CD} \int_{ab} \left(\frac{\mathbf{r}}{r^3} dl_m dl_t \right) \tag{8}$$

In the same way for the force on the segment cd, its expression is the same than equation (8) but the domain of integration is changed from ab to cd:

$$\mathbf{F}_{t2} = -\frac{\mu_0 I_m I_t}{4\pi} \int_{AB+CD} \int_{cd} \left(\frac{\mathbf{r}}{r^3} dl_m dl_t \right) \tag{9}$$

2.2. Forces on the segments ad and bc

The force on the segments ad and bc are computed in the same way than in section 1.2. The segments AB and CD are perpendicular to the segment da (see Figure 6). So, the forces $\mathbf{F}_1$ and $\mathbf{F}_3$ on the half-segment dg are zero:

$$d\mathbf{I}_m \cdot d\mathbf{I}_t = 0 \Rightarrow \mathbf{F}_1 = 0,\ \mathbf{F}_3 = 0$$

But the forces from BC and DA are not zero and the resultant force on the half-segment dg is:

$$\mathbf{F}_{t3} = \mathbf{F}_2 + \mathbf{F}_4$$

On the lower half-segment, the resultant force is $\mathbf{F}_{t4}$.

For the side bc, the forces on the upper and lower half-segments are $\mathbf{F}_{t5}$ and $\mathbf{F}_{t6}$. Like in section 1.2, the forces on upper and lower half-segments have the same value for small test coil:

$$\mathbf{F}_{t3} = \mathbf{F}_{t4},\ \mathbf{F}_{t5} = \mathbf{F}_{t6} \tag{10}$$

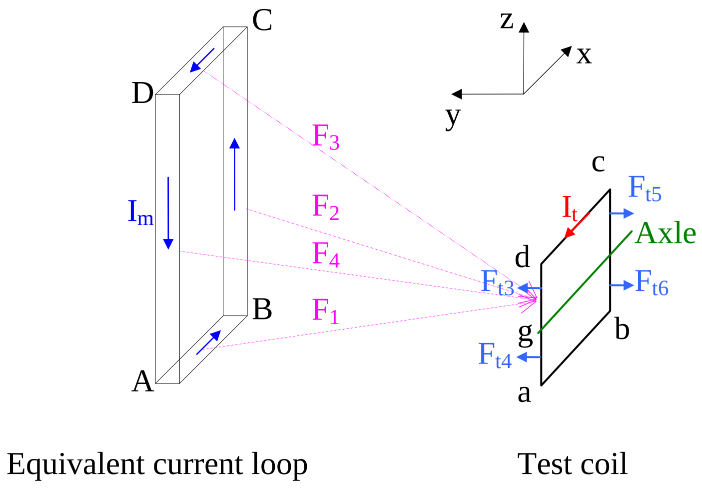

Figure 6

2.3. Torque about x-axis

The axle being parallel to x-axis, the torque of a force is the product of the y-component of the force with its lever arm. The y-components of the forces $\mathbf{F}_{t1}$, $\mathbf{F}_{t2}$, $\mathbf{F}_{t3}$, $\mathbf{F}_{t4}$, $\mathbf{F}_{t5}$ and $\mathbf{F}_{t6}$ are denoted respectively by:

$$F_{t1},\ F_{t2},\ F_{t3},\ F_{t4},\ F_{t5},\ F_{t6}$$

Their lever arms are denoted respectively by l_1, l_2, l_3, l_4, l_5, l_6

So, the total torque about x-axis is:

$$\tau_x = l_1 F_{t1} + l_2 F_{t2} + l_3 F_{t3} + l_4 F_{t4} + l_5 F_{t5} + l_6 F_{t6}$$

The forces F_{t4} and F_{t6} are equal to F_{t3} and F_{t5} respectively (equation (10)), and the resultant torque becomes:

$$\tau_x = l_1 F_{t1} + l_2 F_{t2} + (l_3 + l_4) F_{t3} + (l_5 + l_6) F_{t5}$$

Like in section 1.2, the levers arms l_3 and l_5 are respectively opposed to l_4 and l_6 (see Figure 6), and we have:

$$(l_3 + l_4)=0,\ (l_5 + l_6)=0$$

Then: $$\tau_x = l_1 F_{t1} + l_2 F_{t2}$$

F_{t1} and F_{t2} are the y-components of $\mathbf{F}_{t1}$ and $\mathbf{F}_{t2}$ which are given by equations (8) and (9). So, we have:

$$F_{t1} = -\frac{\mu_0 I_m I_t}{4\pi}\int_{AB+CD}\int_{ab}\left(\frac{\Delta y}{r^3}dl_m dl_t\right),\ F_{t2} = -\frac{\mu_0 I_m I_t}{4\pi}\int_{AB+CD}\int_{cd}\left(\frac{\Delta y}{r^3}dl_m dl_t\right) \qquad (11)$$

where Δy is the y-component of the radial vector **r**.

The lever arms l_1 and l_2 are the half-height of the test coil with opposed signs:

$$l_1 = ad/2,\ l_2 = -\,ad/2$$

The values of F_{t1} and F_{t2} are opposed too. So, the total torque about x-axis is:

$$\tau_x = \frac{\mu_0 I_m I_t}{4\pi}\frac{ad}{2}\left(\left|\int_{AB+CD}\int_{cd}\left(\frac{\Delta y}{r^3}dl_m dl_t\right)\right| + \left|\int_{AB+CD}\int_{cd}\left(\frac{\Delta y}{r^3}dl_m dl_t\right)\right|\right) \qquad (12)$$

So the corrected law predicts a non-zero torque and the test coil will turn about x-axis, fitting the experimental result.

3. Transversal force

In **Lorentz perpendicular action experiment and Lorentz force law,** blogspot academia I write: the fact that the test coil does not turn about y-axis means magnetic field does not transport transversal force, which is perpendicular to the transmission path. Since the corrected law gives magnetic force alone the radial vector **r**, the force does not possess component perpendicular to **r** which is the path of transmission. Thus, magnetic transmission of transversal force is proven to be impossible by experiment and by theory.

4. Equilibrium position

In the case 2, the experiment shows that the test coil stays at an equilibrium position that is horizontal, contradicting the Lorentz force law that predicts the test coil should be perpendicular to the magnetic field vector at equilibrium (see **Lorentz perpendicular action experiment and Lorentz force law,** blogspot academia).

At equilibrium the torque is zero and the nonzero force must be parallel to the lever arm. According to the corrected law and because the segment CD is farther than AB from the test coil (see Figure 5, equations (8) and (9)), the forces $\mathbf{F}_{t1}$ and $\mathbf{F}_{t2}$ are approximately horizontal. The lever arm of these forces is the segment ad and, the test coil must be horizontal to make it parallel to the forces. So, the corrected law predicts the equilibrium position to be horizontal, fitting the experimental result.

5. Comment

In the above analysis, it is shown that the corrected law explains well the experimental result: the test coil should stay still about y-axis, turn about x-axis and stays horizontal at equilibrium. In addition, the corrected law gives the same value than the Lorentz force law for closed loop (see **Correct differential magnetic force law,** blogspot acdgemia). So, the corrected law describes exactly magnetic force.

My experiment answers the question “Is the Lorentz force law right?” only qualitatively, that is, just by yes or no. In order to validate completely the corrected law, we have to measure precisely the value of magnetic force and compare with the theoretical prediction of the corrected law in general situations. This work can only be done in physical laboratory. Dear readers, please help with your laboratory. I will offer my support to carry out the experiment.

Correcting the Lorentz force law is much more than one law. This leads to a major revolution in physics. In fact, electromagnetism is a so well self-consistent theory that a change in one part automatically implies changes in all the theory. For example, in generators Lorentz force does a work on coils, the energy conservation law implies that the current in coils must do an equivalent electric work. If the theoretical value of magnetic force changes, the value of the induced potential must change to fit the work of the corrected magnetic force. Thus, Faraday’s law should be corrected too. If Faraday’s law is corrected, the wave equation should follow, and so on.

My multiple articles already illustrated this domino upheaval with the B-cutting paradox, the wave equation’s flaw and other paradoxes. See for example **B-Cutting Solution,** blogspot academia and **Energy density of electromagnetic wave,** blogspot academia and **Summary**, blogspot, Academia.

I have been publishing on the internet on electromagnetic theory for one year. I have started by proving theoretically the flaw of the Lorentz force law, then B-Cutting paradox, and then the flaw of the wave equation, etc. The more I write the more flaws I find. Finally, I have done this experiment and published the analysis which proves that my theory is right. It is the overhaul of the electromagnetic theory that begins and this is a gigantic work that I cannot do alone.

It is exciting to bring ones own contribution in a revolution. Quantum revolution was not done by one person. Someone has derived the blackbody law; some other proposed the uncertainty principle. Although their names are not cited, you know who they are. There will be similar multiple personal contributions in the present electromagnetism revolution and the mostly involved people will get glory like those in the quantum revolution.

Participation does not mean necessarily doing experiment or propose new theory. Bringing the message and make people know the new theory is also extremely useful since this increases rapidly its influence. Please Tweet, Facebook, Googl+ or Email to other people the pages of the new theory to accelerate the revolution. A little click can do greatly.