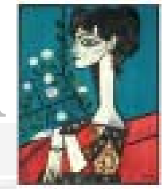
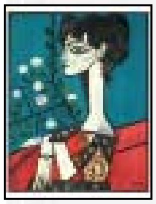


New Induction and the Neumann Equation



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NI and Neumann

New Induction and the Neumann Equation

This document will show that New Induction is a superset of Neumann's equation in spite of the fact that Neumann's equation looks remarkably like the wire fragment form of New Induction. The following is the basic Neumann equation found in many textbooks

a) $M_{ab} = K_M \oint_a \oint_b \frac{\mathbf{dL}_a \bullet \mathbf{dL}_b}{r}$ which can then be coupled with

b) $emf_b = -M \frac{di_a}{dt}$ to arrive at

c) $emf_b = -K_M \left(\frac{di_a}{dt} \right) \oint_a \oint_b \frac{\mathbf{dL}_a \bullet \mathbf{dL}_b}{r}$ (for closed loops only: Transverse field)

This looks identical to the application of New Induction to a mutual system which looks like this:

d) $emf = -K_M \left(\frac{di_S}{dt} \right) \int_S \int_T \frac{\mathbf{dL}_S \bullet \mathbf{dL}_T}{r}$ (closed loop not required: Spherical field)

Though the differences between New Induction and the Neumann equation seem minor, they are actually quite profound. The closed loop ($\oint \mathbf{dL}$) restriction conforms Neumann's equation to the "transverse only" magnetic field of classical electromagnetic theory (Biot-Savart); whereas, New Induction is not limited to closed loops. New Induction teaches that magnetic fields are Spherical (demonstrated later), as such the closed loop restrictions are not required.

The closed loop ($\oint \mathbf{dL}$) requirement of Neumann is also required by it's derivation using Green's theorem, It would be invalid otherwise. On the other hand, New Induction can be applied to any arbitrary path (including paths that cross through any number of dimensions or fractional dimensions) with out necessarily being closed.

The above is only one argument which shows that Neumann's equation is only a special case of (a subset of) the wire fragment form of New Induction.

NI and Neumann

1 Mutual Induction

We could delve into all of the details of the derivation of the Neumann equation to show that it is only a subset of New Induction; however, we can also show that the Neumann equation is a subset of New Induction by working the problem from a different perspective.

Suppose we start from the beginning and assume that we do not know the correct model of induction (or of magnetic fields). To find a model, we run a set of mutual experiments between TWO CLOSED LOOPS and perform a search of mathematical relationships to see which fit the experimental data (as was done with New Induction). Because we have limited the experiment to closed loops (since it is easier to make measurements) then we must explore the possibility that there could be more than one mathematical relationship that will match the experimental values.

To use an analogy, suppose that we have one experiment such that some function of 2 and 2 yields 4. There are many mathematical relationships where 2 and 2 yields 4. The reason why there is more than one mathematical relationship is that we have limited the experiment. By extending the experiment to cover more cases, enables us to eliminate “False positives” such that we may converge on the true relationship.

In this section we will run a mutual induction experiment between TWO CLOSED LOOPS for the purpose of finding ALL of the mathematical relationships that will yield the same result as the experimental data. From experience we know that the experimental data will yield the same results as the Neumann equation which is:

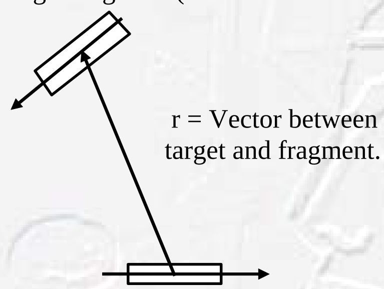
1) $emf = -K_M \left(\frac{di_S}{dt} \right) \oint_S \oint_T \frac{\mathbf{dL}_S \bullet \mathbf{dL}_T}{|\mathbf{r}|}$ (Using New Electromagnetism notion)

Then the question becomes: what other mathematical relationships, between the geometric descriptions of the wires, yields the same results?

Note: the Rules of Nature (RON.pdf) enable us to reject any relationship to the area circumscribed by the wires. See the Mechanism Rule.

To answer this question, we boil the problem down to the most fundamental cause and effect. Each fragment (differential length) of the source loop containing a current change somehow affects each fragment of the target loop based on some geometric relationship between the fragments as shown in the following diagram.

dL_T = Target fragment (vector differential length).



dL_S = Source fragment (vector differential length).

Equation 1: Relationship between fragments

It is assumed that we must integrate the effects of each source fragment on each target fragment to find the total effect that is measured. Because we are limited to measuring closed loops, we are constraining the experiment such that there may be MORE than ONE geometric relationship between fragments that will give us identical answers.

For example, will $(\mathbf{dL_T} \bullet \hat{\mathbf{r}}) \times \mathbf{dL_S}$ work? or perhaps $(\mathbf{dL_T} \bullet \mathbf{r}) \times \mathbf{r}$???

Assuming that the Neumann equation is the correct output; then how many geometric relationships between fragments will give us identical answers?

Off hand I know of two (computer search will reveal if there are others)

The first is the Spherical relationship of New Induction

$$2)\ emf = -K_M \left(\frac{di_S}{dt} \right) \int_S \int_T \frac{\mathbf{dL}_S \bullet \mathbf{dL}_T}{|\mathbf{r}|}$$

Equation 2 is called spherical because the magnitude of coupling between two parallel fragments remains the same as long as the distance between the two fragments remains the same. As such, this coupling model traces out a spherical contour (see Figure 1-1). The Neumann equation is derived from the "transverse only" field model (Biot-Savart) and thus it is required to be constrained to closed loops (more about this later).

The second is the Transverse relationship which is derived from Biot-Savart and F=QVxB in the paper “ne.pdf”. The version found here is slightly different in form, but equivalent in result to the one found in the paper.

$$3)\quad emf = -K_M\left(\frac{di_S}{dt}\right)\int_S\int_T \frac{(d\mathbf{L}_S\times\hat{\mathbf{r}})\bullet(d\mathbf{L}_T\times\hat{\mathbf{r}})}{|\mathbf{r}|}$$

Equation 3 is called a transverse relationship because the magnitude of coupling between two parallel fragments is maximum when transverse and zero when longitudinal (see Figure 1-2). This coupling model traces out a contour that is toroidal. This “transverse only” field is the same used to derive the Neumann equation and all other magnetic field interactions of classical physics. It will be shown later that this model is a superset of the Neumann equation.

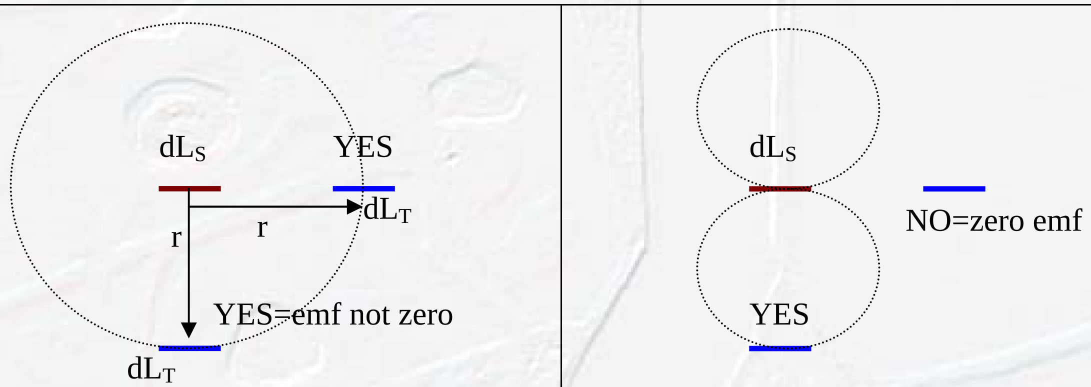


Figure 1-1 Spherical relationship between fragments

Figure 1-2 Transverse Relationship between fragments

When either 2 or 3 are constrained to a system of closed loops, they both yield the EXACT SAME RESULT as the Neumann equation and thus can be placed into the form of the Neumann equation shown in 1. Then we ask the important question: when not constrained to closed loops, then which one yields the correct results? In order to answer this question we need another experiment to help us reduce the set of answers.

2 Self Induction

Those who have read the paper New Induction (ni.pdf), and followed the experiments, are aware of the fact that the self induction experiment (the Rhombus Experiment) also yields two "inter-fragment" geometric relationships that result in excellent agreement with the experimental data.

The first geometry is 5,0,0,8 which is the same spherical relationship shown in the previous section.

4) $emf = -K_M\left(\frac{di_S}{dt}\right)\int_S\int_T \frac{\mathbf{dL}_S \bullet \mathbf{dL}_T}{|\mathbf{r}|}$ (S and T are different fragments of same loop)

The second is geometry is 5,0,7,9 which is describes a LONGITUDINAL field; not TRANSVERSE as in the mutual induction case. This relationship is:

5) $emf = -K_M\left(\frac{di_S}{dt}\right)\int_S\int_T \frac{(d\mathbf{L}_S \bullet \hat{\mathbf{r}})(d\mathbf{L}_T \bullet \hat{\mathbf{r}})}{|\mathbf{r}|}$ (S and T are different fragments of same loop)

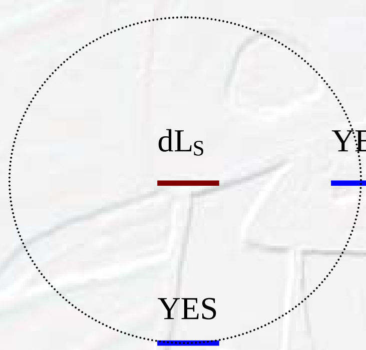


Figure 2-1 Spherical relationship between fragments

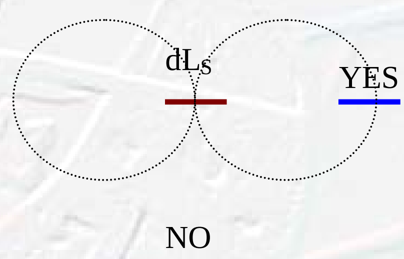


Figure 2-2 Longitudinal Relationship between fragments

The above diagrams are self explanatory to those who have read and understood the previous section.
Note: The Longitudinal contour is two end to end volumes that are "sphere like."

3 Is it Obvious?

I'm sure that many of you can see that the spherical model survives both experiments. What may not be obvious is the fact that the summation of equations 3 and 5 yield the Spherical model of New Induction.

The derivation of Neumann's equation using Green's theorem ensures that the model is constrained to provide answers that conform to the accepted "Transverse only" model of classical magnetic field theory (Biot-Savart). This is demonstrated by the fact that New Induction (spherical model) when applied to a closed loop mutual systems, yields the same answer as a "transverse only" magnetic field.

If the magnetic field is a spherical entity, then the closed loop restriction is not required (Hence we have New Induction). There are many other experiments (and proofs), in New Induction and New Magnetism, which provide evidence that magnetic fields are spherical (see next chapter). As such, the spherical field of New Induction (which was found through experiment) is essentially a superset of all equations in this paper to include Neumann's equation (see chart in Figure 3-1).

To reiterate, because of the closed loop constraints required by Green's theorem, the Neumann equation can not be construed to anticipate a Spherical magnetic field structure. This is because the constraints enable both the "Transverse only" field of classical electromagnetism and the Spherical field of New Electromagnetism to yield the same answer. Furthermore, because of Green's Theorem, Neumann's equation absolutely requires a closed loop.

New Induction, which was found through experiment, is not constrained to closed loops. New Induction readily anticipates a spherical field; and, unlike classical electromagnetic induction, it is not ambiguous when applied to point charges in free space.

Figure 3-1 shows a set diagram that relates the various models. The most comprehensive model is the Point Charge Form of New Induction (BLUE). A subset of this is the Wire Fragment Form (RED). The Wire Fragment Form can be broken down into two exclusive subsets called the Longitudinal (RIGHT HALF of RED) and Transverse components (LEFT HALF of

RED). Since the Transverse component can be derived from the classical motional electric law (F=QvxB), they both predict the same subset of interactions. It is shown in the paper classfluxan.pdf that Faraday's Law (BLACK) is a subset of F=QvxB; as such, it occupies a smaller area of F=QvxB. The closed loop restrictions of Neumann's equation (due to Green's Theorem) do not permit it to predict interactions beyond that which can be predicted by Faraday's Law. This is true in spite of the fact that the geometry appears to be the same as New Induction.

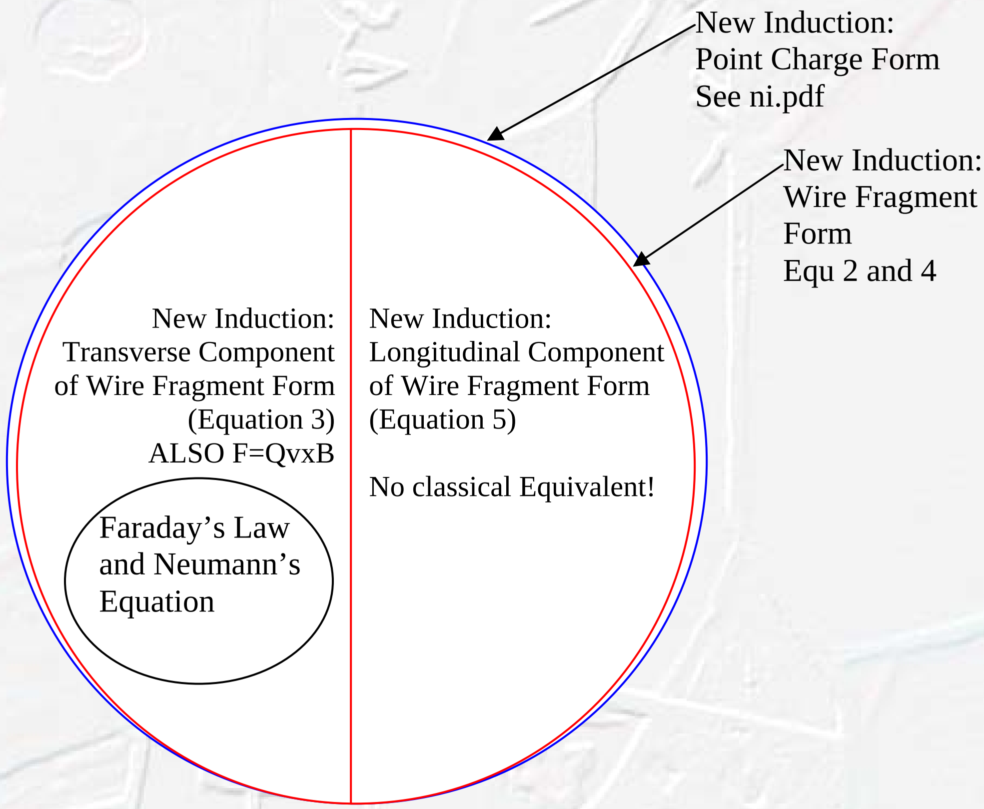


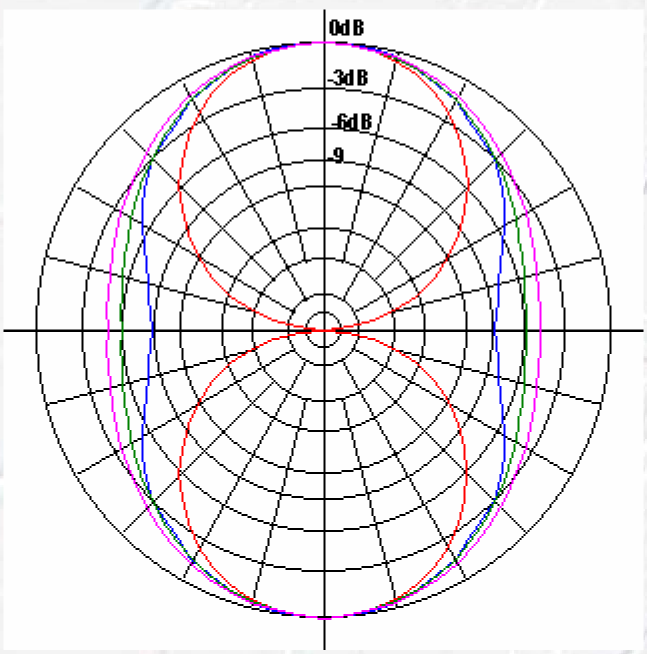
Figure 3-1 set diagram of different models

Note: although the Point Charge Form (BLUE) and Wire Fragment Form (RED) of New Induction are interchangeable from the standpoint of the original paper (ni.pdf), there are considerations with regard to the behavior of charges in a conductive medium that can only be addressed through application of the Point Charge Form. Some of these considerations are addressed in the book New Magnetism (BK001).

4 Proof of the longitudinal Components

Since the mutual induction between two closed loops causes the longitudinal components to cancel, then we would like to study the mutual induction between two "non-closed loops." The first response from many readers might be outright laughter at this moment; after all, it is well know that closed loops are required for current to flow. However, radio antennas are a well known case in which charges are in motion regardless of the fact that the circuit is not closed.

In our book "New Induction Applications Volume 1" (NIA1—BK101) we derive a retarded time version of New Induction specifically for resonant dipole coupling (comes with software source code). The following diagram shows the comparison of the different models along with experimental data (BLUE) from the American Radio Relay League (arrl.org)



In the above diagram, a source dipole antenna is situated at the center oriented horizontally. A target antenna is then moved around the source such that it is always parallel and equidistant to the source. The colored plots indicate the received intensities normalized to the maximum position.

The BLUE trace is the measured data obtained from the ARRL Antenna book (it includes ground effects). The red trace is the footprint predicted by the transverse only model (Maxwell, Biot-Savart, etc) of classical electromagnetism. The green trace is that predicted by New Induction without ground effects. The pink trace is that predicted by New Induction with Ground Effects using the ARRL ground effect model (we may have applied it backwards – we plan to look at this again later).

In any event, there is less discrepancy between Mother Nature and the spherical field model of New Induction.

There are other proofs to the validity of the spherical field model of New Induction and New Magnetism. The Paradox 2 Experiment and the rigorous mathematical proof found in the book New Magnetism are some examples. The New Magnetism proof (included in BK001) shows that, without the spherical magnetic field, classical theory predicts phenomena that have never been observed.

Appendix A. Other Notes

The Neumann equation is derived using vector magnetic potential, it is simplified by assuming that the magnetic effects from each source fragment arrive at all points on the target simultaneously in order to keep the application of Green's theorem from becoming messy. Therefore it is very difficult to re-derive Neumann's equation to account for propagation delay and interference. New Induction readily permits the use of retarded time techniques which predict accurate antennae radiation patterns for which classical electromagnetic theory has been lacking (see the book NIA1).

