



The Quintessential Argument

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ABSTRACT

This argument provides a very simple demonstration that the “[New Induction](#)” model is a more complete description of the natural phenomenon known as Electromagnetic Induction than classical electromagnetism (specifically Faraday’s Law, which includes Maxwell’s version). This is accomplished by showing that Electromagnetic Induction is a reciprocal phenomenon for which New Induction, not Faraday’s Law, accounts for all aspects of measurable reciprocity.

This paper contains worked out examples of both the New Induction model and Faraday’s Law.

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New Induction: Point Charge form	New Induction: Wire Fragment form	Faraday’s Law:
$\mathbf{F} = \frac{-K_M Q_S Q_T \mathbf{a}_S}{ \mathbf{r} }$	$emf_{TS} = -K_M \left(\frac{dI_S}{dt} \right) \frac{d\mathbf{L}_S \bullet d\mathbf{L}_T}{ \mathbf{r} }$	$emf = -N \frac{d\Phi}{dt}$

Note: This paper is condensed from segments found in the papers “New Induction” and “Rules of Nature” found at www.Distinti.com. The New Induction models were found through experimental means by Robert J. Distinti.



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1 An Overview of Induction

Figure 1 shows an empirical way to determine the mutual inductive linkage (M) between two loops of wire. By exciting loop 1 with a time changing current, loop 2 will develop an emf. The mutual inductive linkage (M) is calculated by dividing the emf in the second loop by the current change in the first loop. For the sake of discussion we call this the “Forward Linkage” and give it the symbol (M_{12}).

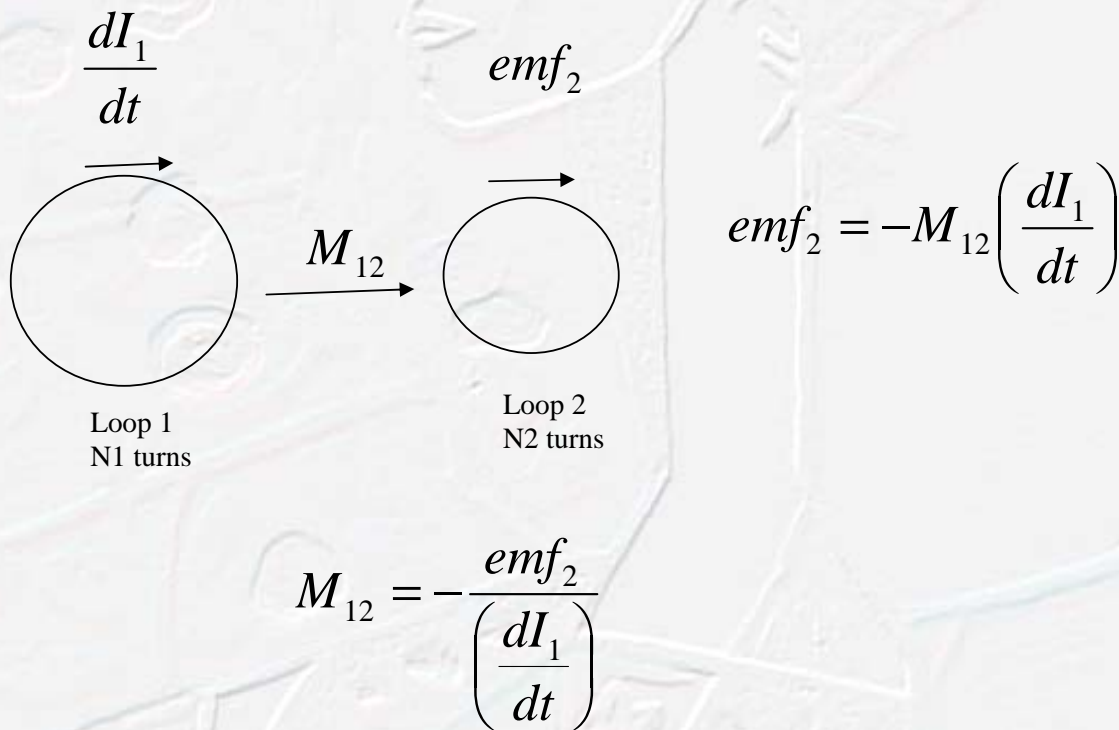


Figure 1: Forward Linkage

Next, Figure 2 shows the experiment run in reverse, where the current change is applied to the second loop and the emf is measured in the first loop. For the sake of discussion we call this the “Reverse Linkage” and give it the symbol M_{21} .

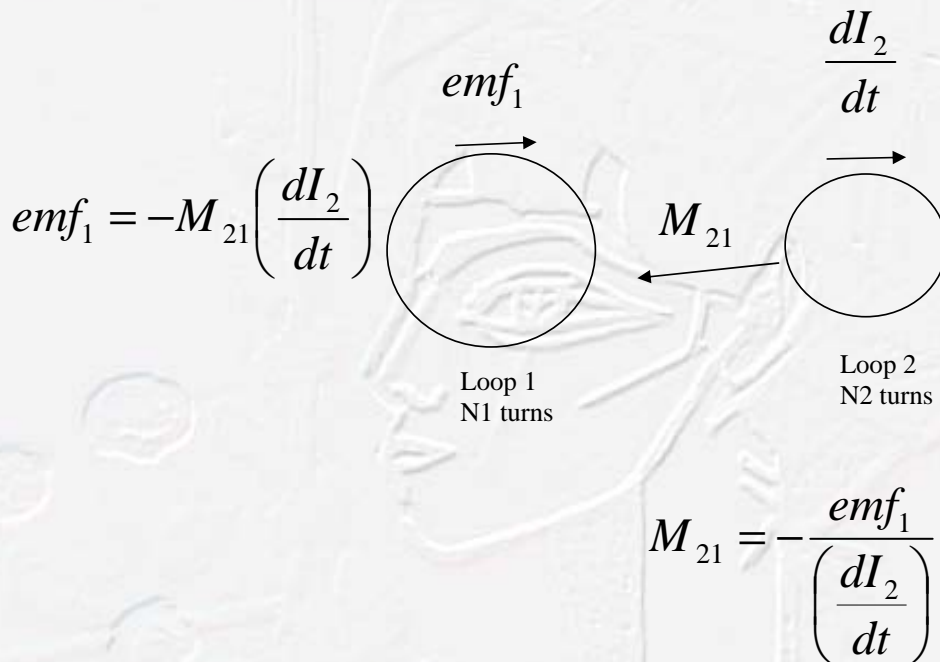


Figure 2: Reverse Linkage

The above experiments demonstrate the empirical way to determine both the forward (M_{12}) and reverse (M_{21}) mutual inductive linkage.

In both the forward and reverse case, the inductive linkage can be calculated electromagnetic theory using either the classical model of induction (Faraday's Law) or the New Induction model.



2 Reciprocity

Well known to scientists and engineers, for more than 100 years, is the fact that the forward mutual inductive linkage is the same as the reverse linkage ($M_{12} = M_{21}$). This phenomenon is called reciprocity.

The next step is to show an experiment where reciprocity is not predicted by the classical models; this is done with an example of Fragment-to-Loop induction. In the example, Faraday's Law (the classical model) predicts linkage in the forward case but not the reverse; whereas, the New Induction model predicts identical linkage in both directions. These examples are demonstrated mathematically after the New Induction model is introduced.



3 The New Model of Induction

The most basic form of the new model for induction (See the paper "[New Induction](#)" at www.Distinti.com) is given by the following Charge-to-Charge relationship:

$$\mathbf{F} = \frac{-K_M Q_S Q_T \mathbf{a}_S}{|\mathbf{r}|} \quad K_M = \frac{\mu}{4\pi} = 10^{-7}$$

New Induction is described as follows:

An accelerating charge (the source Q_S) will induce a force on another charge (the target Q_T) in a direction parallel to the acceleration of the source (\mathbf{a}_S).

The magnitude of the force is proportional to the acceleration of the source and inversely proportional to the distance (r) between source and target. If the source and target are like charges, then the direction of the force is opposite to the direction of acceleration; otherwise, the direction of force is in the same direction.

By the substitution of the "charge to fragment" conversion identity (see the paper "[New Electromagnetism](#)"), this equation is transformed into the following Fragment-to-Fragment relationship:

$$emf_{TS} = -K_M \left(\frac{dI_S}{dt} \right) \frac{d\mathbf{L}_S \bullet d\mathbf{L}_T}{|\mathbf{r}|}$$

In the above Fragment-to-Fragment model, we see that the cosine between fragment directions, magnitude of current change and distance between fragments, affects the amount of energy coupled from source to target. From this observation we see that orthogonal running wires do not affect each other; whereas, parallel wires couple maximum effect (relative to current and distance)



The next step in this proof is to apply both the New Induction model and Faraday's Law to a Fragment-to-Loop example. Let us begin by introducing the concept of Fragment-to-Loop linkage.



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4 Wire Fragment Induction (Fragment-to-Loop)

Suppose we wanted to know the effect of a current change in a small length of loop1 (a fragment) on the second loop (see Figure 3). For the sake of discussion we refer to this as the “Forward Linkage”

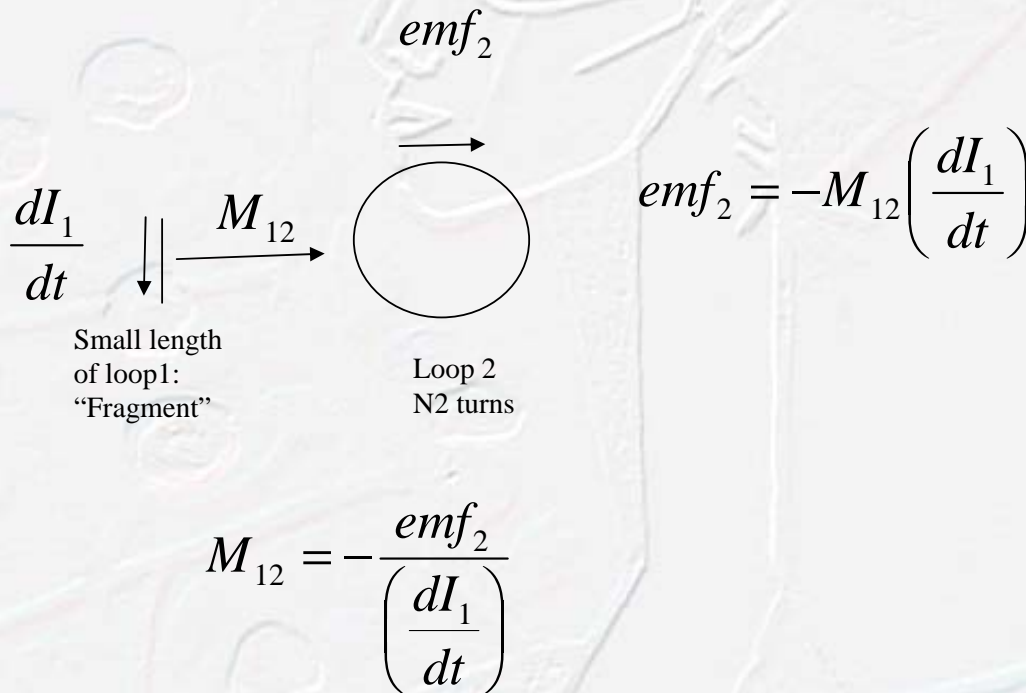


Figure 3: Fragment-to-loop Forward Linkage

In this example, Faraday’s Law is capable of calculating the inductive linkage (M_{12}) from the fragment to the loop (Fragment-to-Loop linkage). A complete example of this derivation is shown arithmetically in the next section.

Note: A mathematically worked out example is shown in the next section of this paper.



From our understanding of reciprocity, we surmise that the reverse linkage (from the loop to the fragment) must be the same ($M_{12} = M_{21}$); however, it is impossible to use Faraday's Law to confirm this. One may argue that Maxwell's equations can be used to determine the reverse linkage; however, this would only be an approximation AND it would only be accurate when the length of the fragment approaches zero length.

We must remember that Maxwell's Equations are derived from Faraday's Law (and others); therefore, if Faraday's law is proven not to be a complete description of Electromagnetic Induction, then Maxwell's equations are not a complete description of electromagnetic wave phenomenon.

This paper is only one of many arguments which suggest that Faraday's Law is not a complete description of the phenomenon of electromagnetic induction. See the paper "Classic Flux Anomaly" for a contradiction of classical induction with regard to magnetic cores.

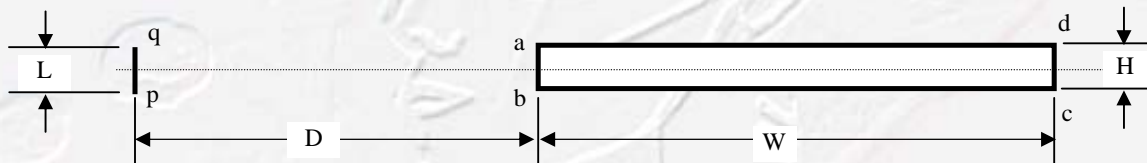
Returning to the Fragment-to-loop example; since a fragment can source inductive energy, then reciprocally, a fragment should be able to receive energy; logically then, a fragment-to-fragment model for induction should exist. Furthermore, it follows that if a fragment-to-fragment model for induction exists, then so should a charge-to-charge model for induction (this follows from the fact that charges are the "things" that create, and react to, electromagnetic fields). This is the basic argument that led to the search and discovery of the New Induction model. The New Induction Model confirms (as shown in a later section) that the forward and reverse linkages of the Fragment-to-Loop example are identical (as it should be).

The next section contains an applied example of fragment to loop induction.



5 Forward Fragment-to-Loop linkage

This section applies both Faraday's Law and New Induction to a simple fragment-to-loop example to demonstrate to the reader that both models yield exactly the same result.



Given the above system where conductor segment (pq) carries a time changing current (di/dt); find the emf induced in the conductive loop (abcd). For simplicity, assume that the length D is much much greater than L and H. The direction of di/dt is from p to q (toward top of page).



USING FARADAY'S LAW

Writing down the two equations required :

$$d\mathbf{B} = \mu \frac{(I d\mathbf{L} \times \hat{\mathbf{r}})}{4\pi|\mathbf{r}|^2} \text{ and } emf = -N \frac{d\Phi}{dt}.$$

Because $D \gg H$ and since the target loop is located directly transverse to the fragment we can use the following

$$\text{approximation } B = -\mu \frac{(IL)}{4\pi r^2}.$$

The minus sign comes from resolving the cross product.

Substitute I with di/dt :

$$\frac{dB}{dt} = -\frac{di}{dt} \frac{\mu L}{4\pi r^2}$$

The quantity $d\Phi/dt$ is found by integrating dB/dt over the area enclosed by the loop.

$$\frac{d\Phi}{dt} = -\int_H^D \int \frac{di}{dt} \frac{\mu L}{4\pi r^2} dHdW.$$

The integration can be simplified by realizing that the field intensity for this problem varies little as a function of height; therefore, we use the following approximation:

$$\frac{d\Phi}{dt} = -\frac{di}{dt} \frac{\mu LH}{4\pi} \int_D^{D+W} \frac{1}{r^2} dr.$$

$$\frac{d\Phi}{dt} = \frac{di}{dt} \frac{\mu LH}{4\pi} \left(\frac{1}{D} - \frac{1}{D+W} \right)$$

Since $emf = -N \frac{d\Phi}{dt}$ and there is only one turn in the loop ($N=1$) then:

$$emf = -\frac{\mu LH}{4\pi} \left(\frac{di}{dt} \right) \left(\frac{1}{D} - \frac{1}{D+W} \right).$$

USING NEW INDUCTION

Writing down the wire fragment form of the New Induction:

$$emf_{TS} = -\frac{\mu}{4\pi} \left(\frac{dI_S}{dt} \right) \frac{d\mathbf{L}_S \cdot d\mathbf{L}_T}{|\mathbf{r}|}.$$

Only line segments parallel to the source are affected. Thus, we need only consider segments (ba) and (cd).

The emf contributed by (ba) is given by:

$$emf = -\frac{\mu}{4\pi} \left(\frac{di}{dt} \right) \frac{LH}{D}.$$

The emf contributed by (cd) is:

$$emf = -\frac{\mu}{4\pi} \left(\frac{di}{dt} \right) \frac{LH}{(D+W)}.$$

Since the directions of both emfs are downward, they oppose each other in the loop; therefore, the total emf is the difference between the two:

$$emf = -\frac{\mu LH}{4\pi} \left(\frac{di}{dt} \right) \left(\frac{1}{D} - \frac{1}{D+W} \right).$$

The direction of the emf is ccw around the loop for positive values of di/dt .

Note: If you had trouble following the above derivation, the reverse linkage example (found in the next few pages) is almost identical and is described in much more detail.



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To find the inductive linkage (M) we divide by $-di/dt$. For both cases, this

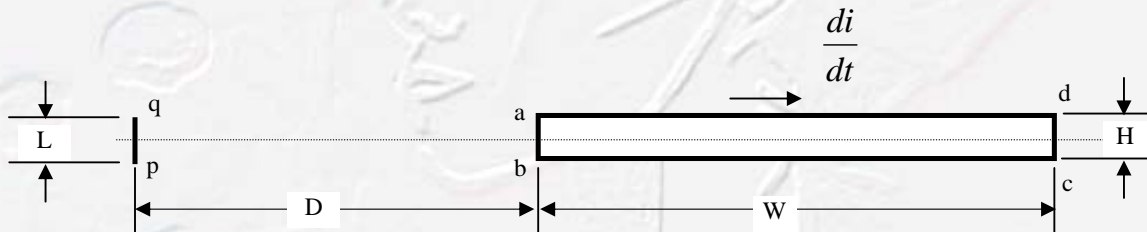
$$\text{yields: } M = \frac{\mu LH}{4\pi} \left(\frac{1}{D} - \frac{1}{D+W} \right)$$

This section shows arithmetically that New Induction and Faraday's Law yield identical results for the forward linkage example.



6 Reverse Fragment-to-Loop linkage

According to the reciprocal nature of induction, the forward and reverse linkage should be identical. Let's apply the two models again, in reverse, to find the effect of the loop on the fragment. If our models are correct, then the reverse calculation should yield the same result.



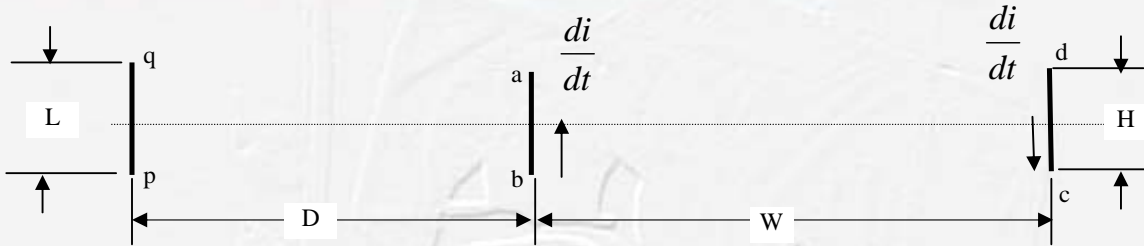
Let loop (abcd) carry a time changing current (di/dt). Find the emf induced in the conductive fragment (pq). For simplicity, assume that the length D is much much greater than L and H. The direction of di/dt is clockwise around the loop.

Faraday's law is impossible to apply to this case.

Applying New Induction:

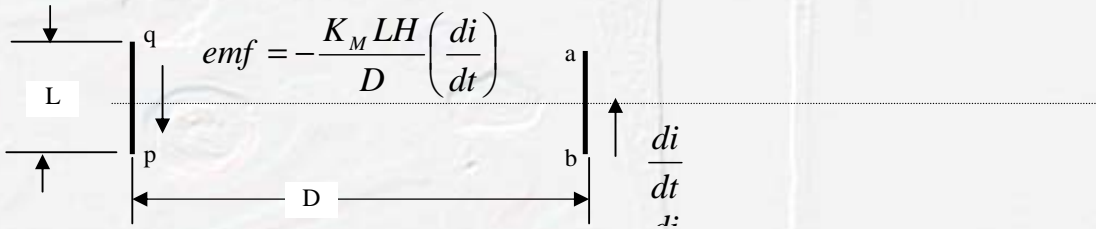
The derivation of the reverse linkage is just as simple as the forward linkage (previous section); it is performed here in greater detail to aid those readers who did not follow the previous example.

Remembering that the fragment-to-fragment model of New Induction shows no linkage for orthogonal wires; therefore, we omit the effects of the horizontal segments (ad, bc).



This leaves only the following effects $ba \rightarrow pq$, and $cd \rightarrow pq$

First we consider the effects of (ba) on the target (pq). Normally, the application of the fragment-to-fragment model requires a dual line integral over both the source and target; however, since we have specified that the distance (D) is much larger than either the length (L) of the fragment or height (H) of the loop, then an excellent approximation for emf is obtained by simply plugging the variables into the New Induction equation:



The above emf is negative since it is in the opposite direction as segment pq.

Next we consider the effects of fragment (cd):



The above emf is positive since it is in same direction as segment pq.

The total emf is the summation of the two effects:

$$emf = -K_M LH \left(\frac{di}{dt} \right) \left(\frac{1}{D} - \frac{1}{D+W} \right)$$



Or

$$emf = -\frac{\mu LH}{4\pi} \left(\frac{di}{dt} \right) \left(\frac{1}{D} - \frac{1}{D+W} \right)$$

To find m, we divide both sides by $-di/dt$, thus:

$$M = \frac{\mu LH}{4\pi} \left(\frac{1}{D} - \frac{1}{D+W} \right)$$

This result is identical to the previous. This shows that the New Induction model correctly reflects the reciprocal nature of electromagnetic induction.



7 Conclusion

The new model for electromagnetic induction ([New Induction](#)) reflects the reciprocal nature of electromagnetic induction in all cases. This is not so with the classical model of induction (Faraday's Law) since it only accounts for a limited set of possible interactions.

New Induction also shows that a magnetic field is spherical in nature. This is different from the Biot-Savart (transverse) field model of classical electromagnetism.

Finally, New Induction permits theoretical applications that suggest that electromagnetic induction is the mechanism of inertia. It is from these observations that the new model was named the Inertia Electric Law (IEL).

Another paper published at our site titled "Classic Flux Anomaly" shows a contradiction of classic field theory as applied to magnetic core material. This anomaly of classic field theory is corrected with New Magnetism concepts. The corrected classical flux model shows that Faraday's Law is only a special case of the classical Motional Electric Law and not a fundamental model of nature. Since Faraday's Law is a critical component of Maxwell's equations; then consequently, Maxwell's equations describe only a "special case" of a more complete electromagnetic wave model.

Since the Spherical Magnetic field uncovered by New Induction is the foundation for all of the New Electromagnetism Research (which includes the New Motional Electric Law defined in the paper "New Magnetism") then this quintessential argument is an argument for the entire body of work on New Electromagnetism.

The discovery of the New Induction models, the spherical magnetic field and the New Electromagnetic models is solely the work of Robert J. Distinti.