Analysis of Leon Dragone's, "Energetics of Ferromagnetism"

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Version 5a

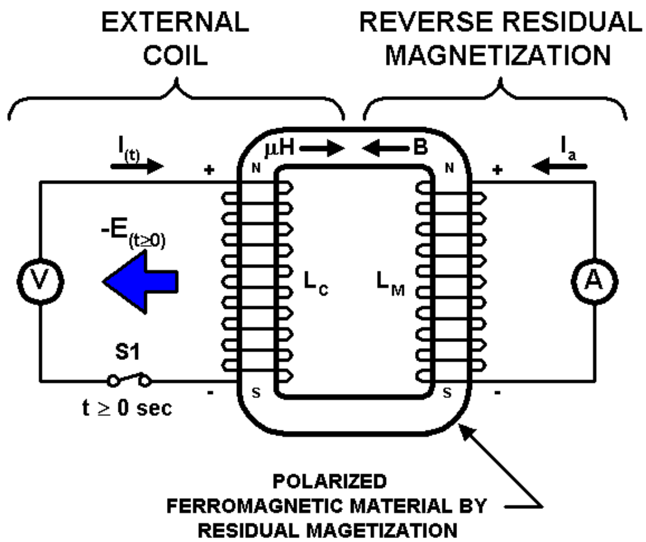

Figure 1.

By applying classical transformer analysis, the total field energy for t ≥ 0 sec is given as:

$$E_{in} = \underbrace{\tfrac{1}{2} L_m I_a^2 + \tfrac{1}{2} L_c I_{(t)}^2}_{\text{POSITIVE ENERGY COMPONENTS}} \underbrace{- M\, I_a I_{(t)}}_{\text{NEGATIVE ENERGY COMPONENT}}$$

where,

L_m is the virtual magnet inductance.
I_a is the virtual atomic current of magnet.
L_c is the inductance of the coil.
$I_{(t)}$ is the coil current.
M is the mutual inductance of the coil/magnet system.

$E_{(t\geq 0)}$ is impulsive output negative energy.

Given:

$Tstart := 0 \cdot sec$

$Tend := 0.1 \cdot sec$

$T := Tstart\ ,\ 0.0005 \cdot sec\ ..\ Tend$

$V := 950 \cdot volt$

$R := 20000 \cdot ohm$

$Lc := 2000 \cdot H$

$Istart := 0 \cdot amp$

$$Iend := V \cdot \frac{\left(1 - \exp\left(-R \cdot \frac{Tend}{Lc}\right)\right)}{R}$$ $Iend = 0.03A$

$t := 0.050 \cdot sec$ $f := \frac{1}{2t}$ $f = 10Hz$

$$i := V \cdot \frac{\left(1 - \exp\left(-R \cdot \frac{t}{Lc}\right)\right)}{R}$$ $i = 0.019A$

Compute Current Through Coil:

$$i(T) := V \cdot \frac{\left(1 - \exp\left(-R \cdot \frac{T}{Lc}\right)\right)}{R}$$

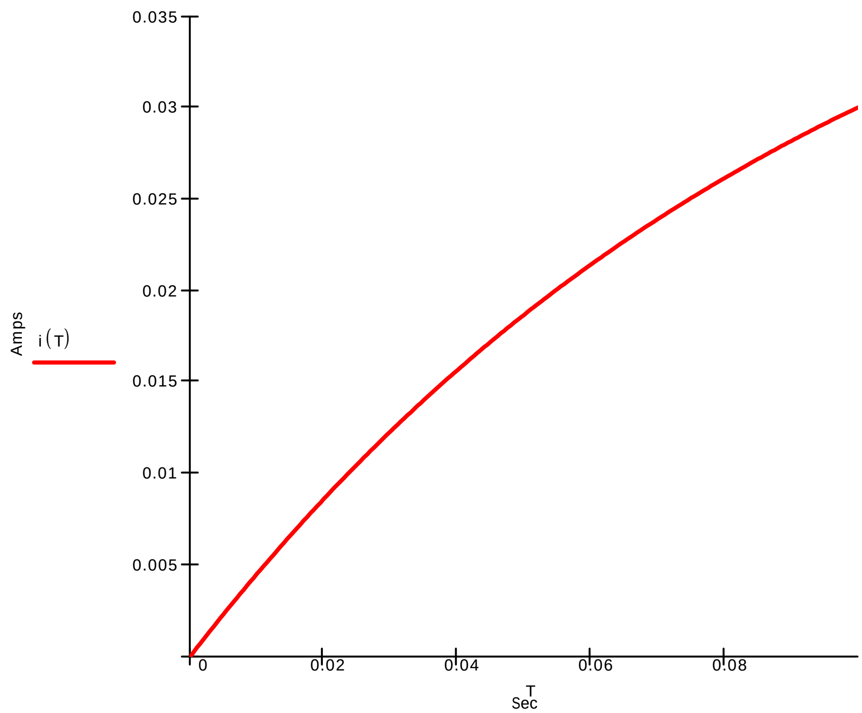

Figure 2

Compute Voltage Across Resistive Portion of Coil:

$Vr(T) := R \cdot i(T)$

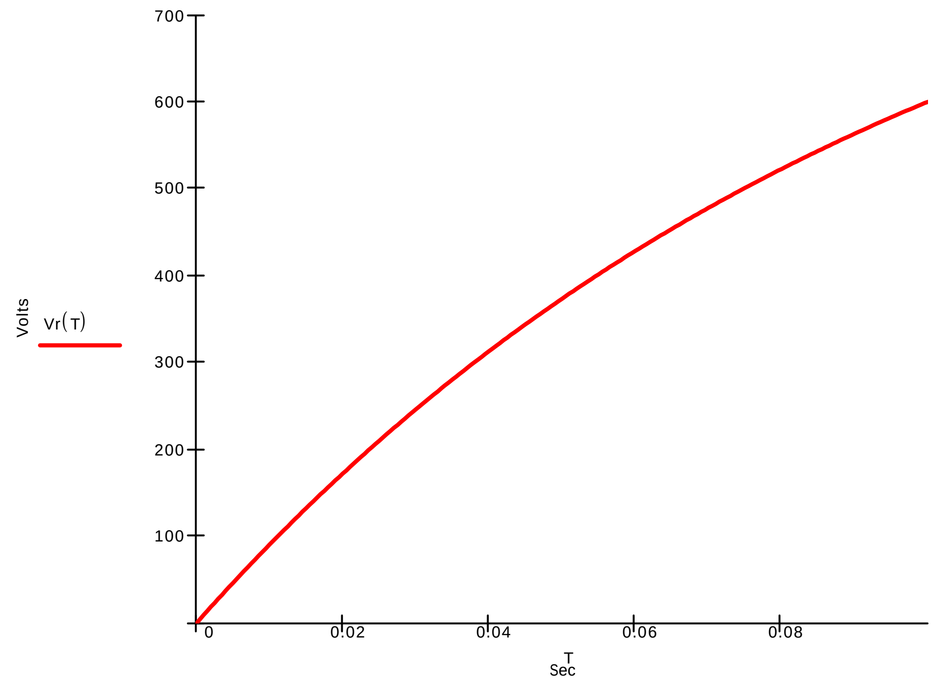

Figure 3

Compute Power Dissipated By Resistive Portion of Coil:

$$Pr(T) := R \cdot (i(T))^2$$

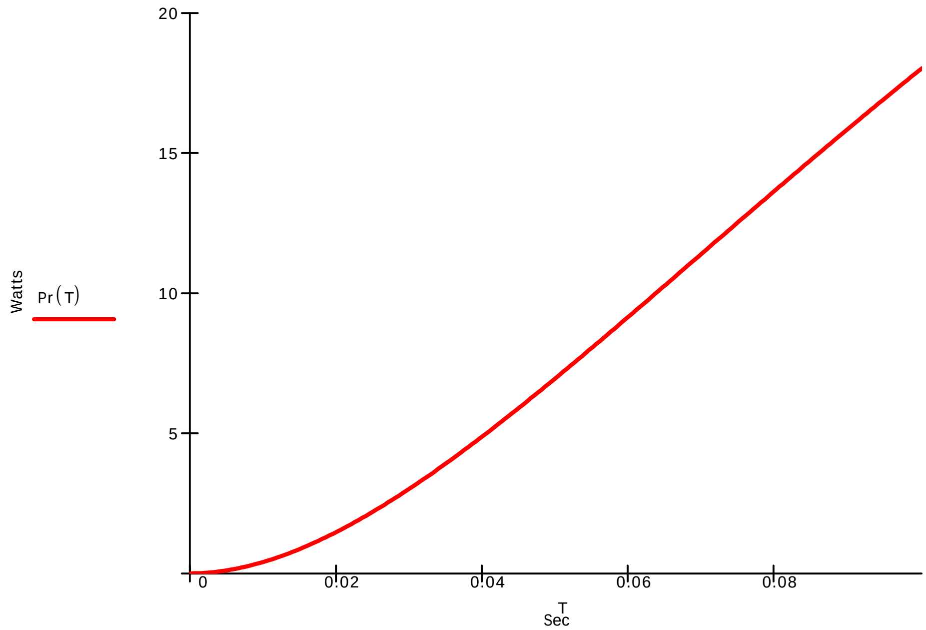

Figure 4

$$Pr := R \cdot (i(Tend))^2$$

$Pr = 18.031W$

Compute Voltage Across Coil:

$$IDOT(T) := \frac{d}{dT} i(T)$$

$$Vc(T) := Lc \cdot IDOT(T)$$

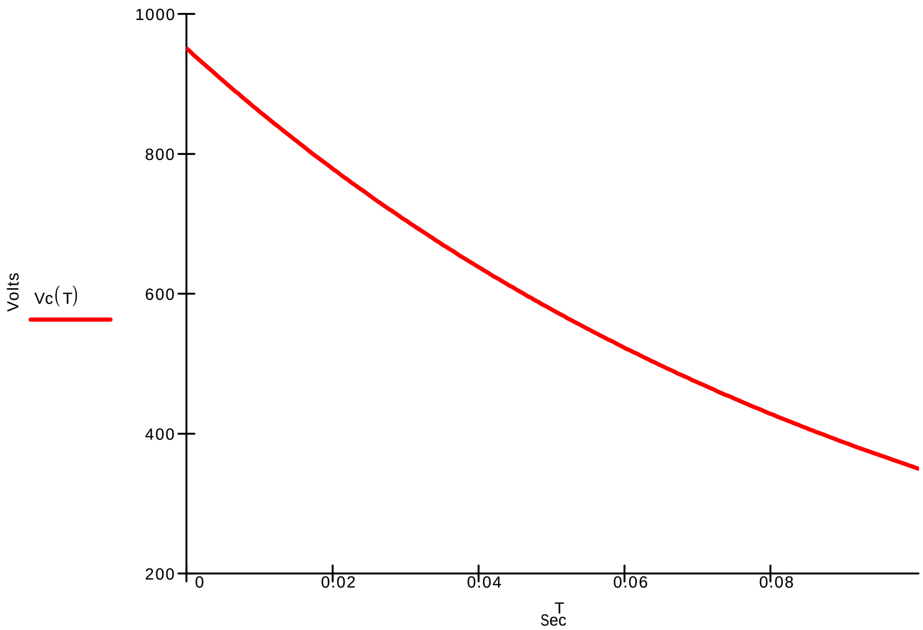

Figure 5

$$Ec := Lc \cdot \frac{(Iend)^2}{2}$$

$$Ec = 0.902\,J$$

Given Atomic Current, Compute Time-Reversed Mutual Energy:

$Ia := 100000 \cdot Iend$ $\qquad Ia = 3002.573A$

$k := 1.0$

$Lm := 0.0001 \cdot \mu H$

$Em := Lm \cdot \frac{(Ia)^2}{2}$ $\qquad Em = 0J$

$M := k \cdot (Lc \cdot Lm)^{\frac{1}{2}}$ $\qquad M = 0H$

$Emutual := M \cdot Ia \cdot Iend$ $\qquad Emutual = 0.04J$

Compute Time-Reversed Mutual Voltage:

$$Vrev(T) := M \cdot Ia \cdot \frac{IDOT(T)}{i(T)}$$

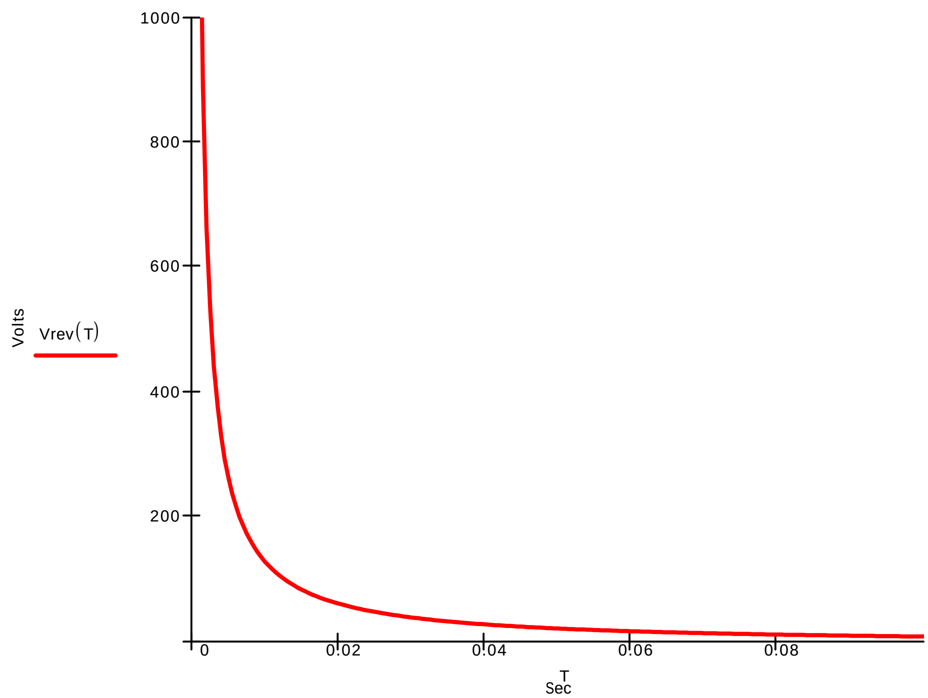

Figure 6

Compute Total Voltage Across Coil:

$Vin(T) := Vc(T) + Vr(T) - Vrev(T)$

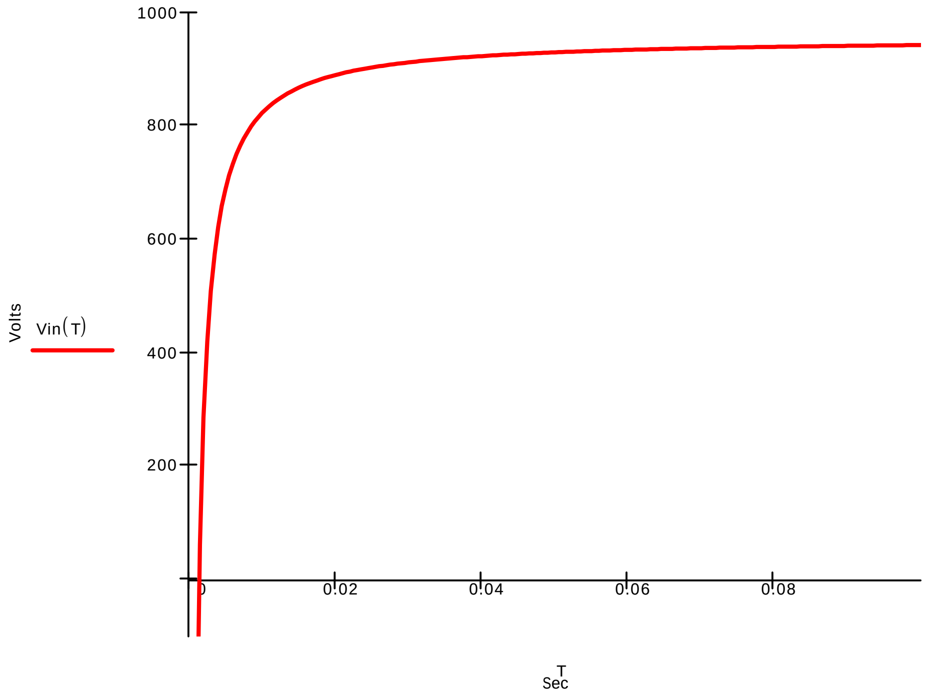

Figure 7

Compute Total Power Dissipated Coil:

$t := 0.000 \cdot sec$

$Pin := Lc \cdot i(t) \cdot IDOT(t) + R \cdot (i(t))^2 - M \cdot Ia \cdot IDOT(t)$ $\quad Pin = -0.638W$

$t := 0.001404 \cdot sec$

$Pin := Lc \cdot i(t) \cdot IDOT(t) + R \cdot (i(t))^2 - M \cdot Ia \cdot IDOT(t)$ $\quad Pin = 0W$

$Pin(T) := Lc \cdot i(T) \cdot IDOT(T) + R \cdot (i(T))^2 - M \cdot Ia \cdot IDOT(T)$

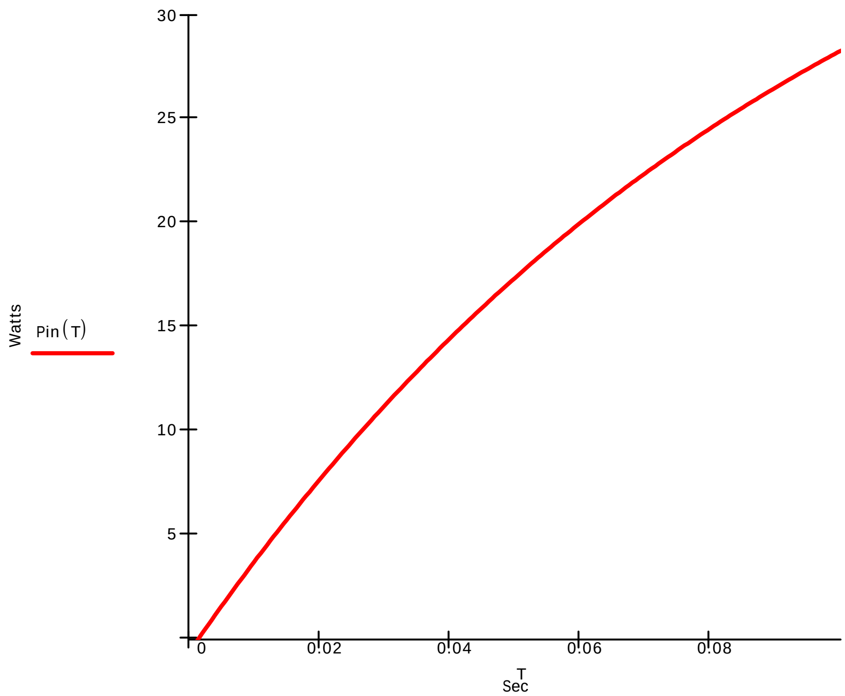

Figure 8

Compute Total Resistance of Coil:

$t := 0.0010 \cdot sec$

$$Rin := \frac{(Vin(t))^2}{Pin(t)}$$ $Rin = -816888.855\,\Omega$

$$Rin(T) := \frac{(Vin(T))^2}{Pin(T)}$$

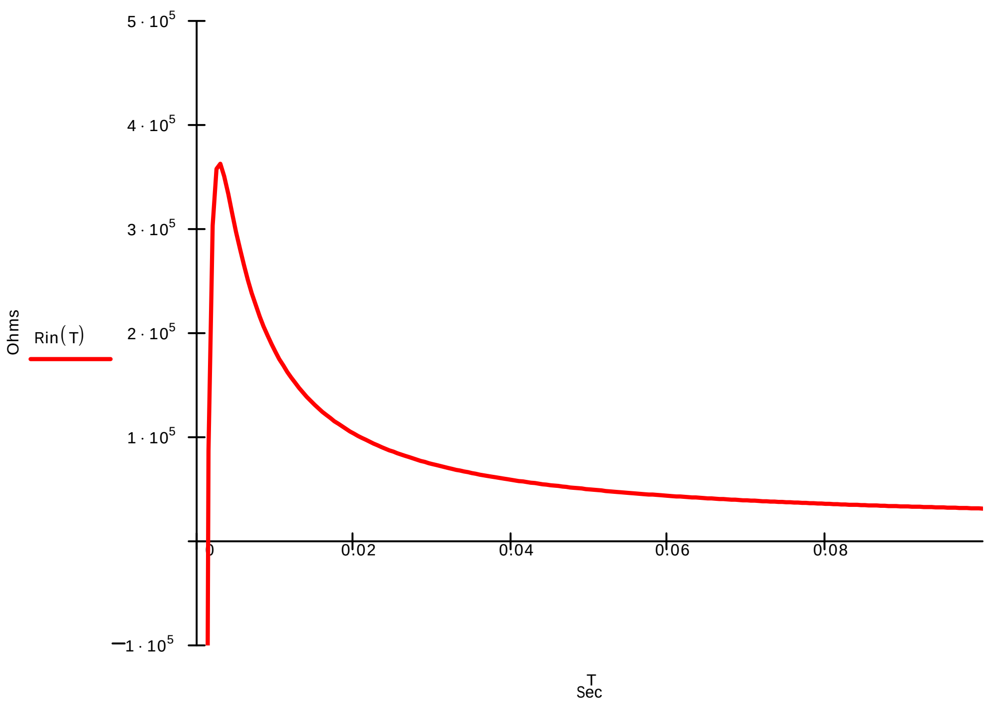

Figure 9

Compute Total Energy of Coil:

$t := 0.050 \cdot sec$

$Ein := \int_{Tstart}^{t} Pin(T)\, dT$ $\qquad Ein = 0.456\,J$

$Ein(T) := \int_{Tstart}^{T} Pin(T)\, dT$

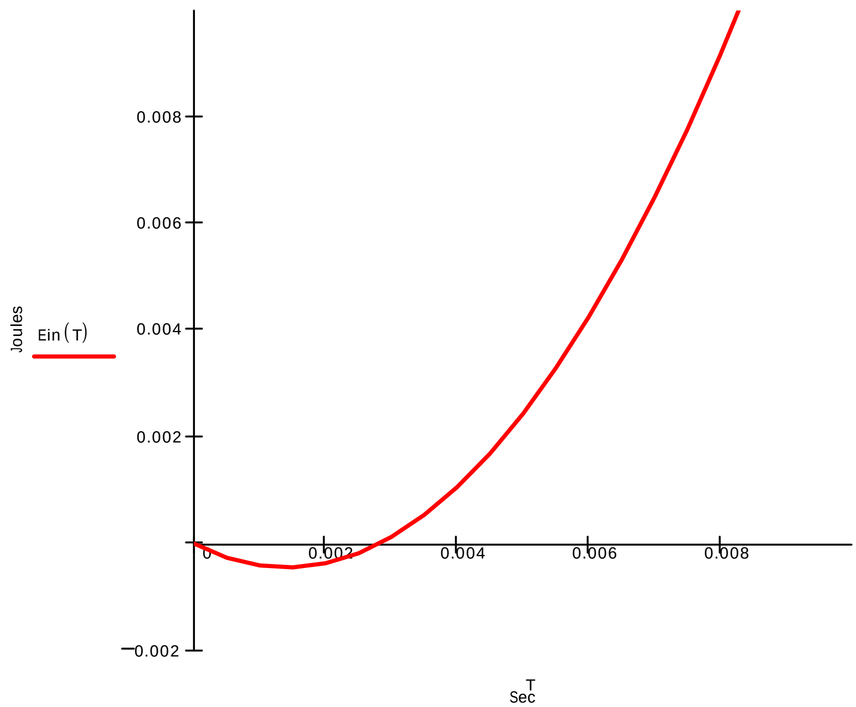

Figure 10

$Vr := R \cdot Iend$ $\qquad Vr = 600.515V$

$IDOTend := \frac{d}{dTend} i(Tend)$ $\qquad IDOTend = 0.175 \frac{A}{s}$

$Vrev := M \cdot Ia \cdot \frac{IDOTend}{Iend}$ $\qquad Vrev = 7.815V$

$Vc := Lc \cdot IDOTend$ $\qquad Vc = 349.485V$

$Vin := Vc + Vr - Vrev$ $\quad Vin = 942.185V$

$Pin := Lc \cdot Iend \cdot IDOTend + R \cdot (Iend)^2 - M \cdot Ia \cdot IDOTend$ $\quad Pin = 28.29W$

$Rin := \frac{(Vin)^2}{Pin}$ $\quad Rin = 31379.266\Omega$

Compute Time-Reversed Impulse Current:

$$Vrev(T) := M \cdot Ia \cdot \frac{IDOT(T)}{i(T)}$$

$$i\_neg(T) := \left[\frac{(V + Vrev(T))}{R}\right]$$

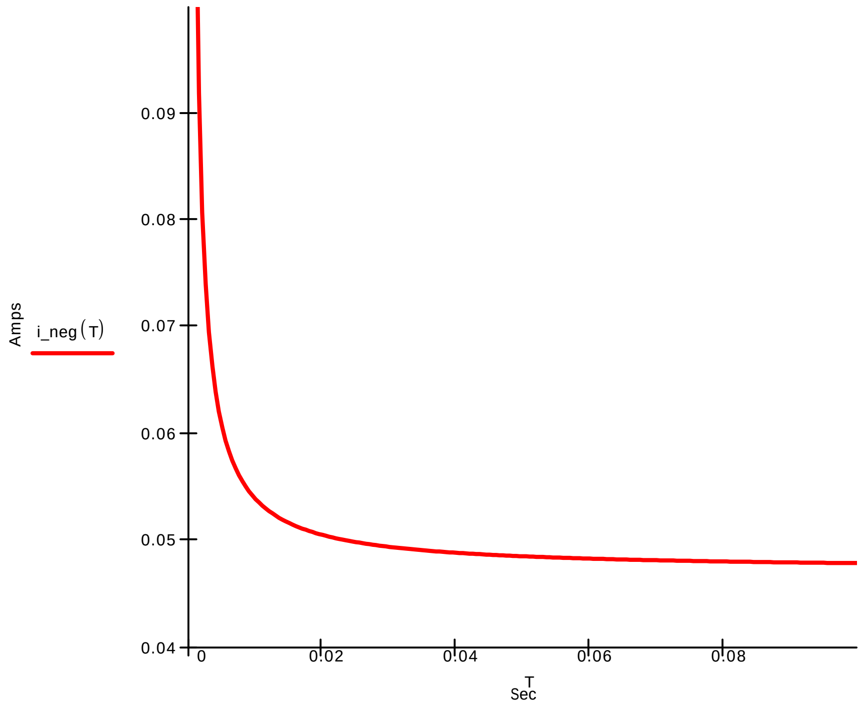

Figure 11

Compute Time-Forward Current:

$$i\_pos(T) := V \cdot \frac{\left(1 - \exp\left(-R \cdot \frac{T}{Lc}\right)\right)}{R}$$

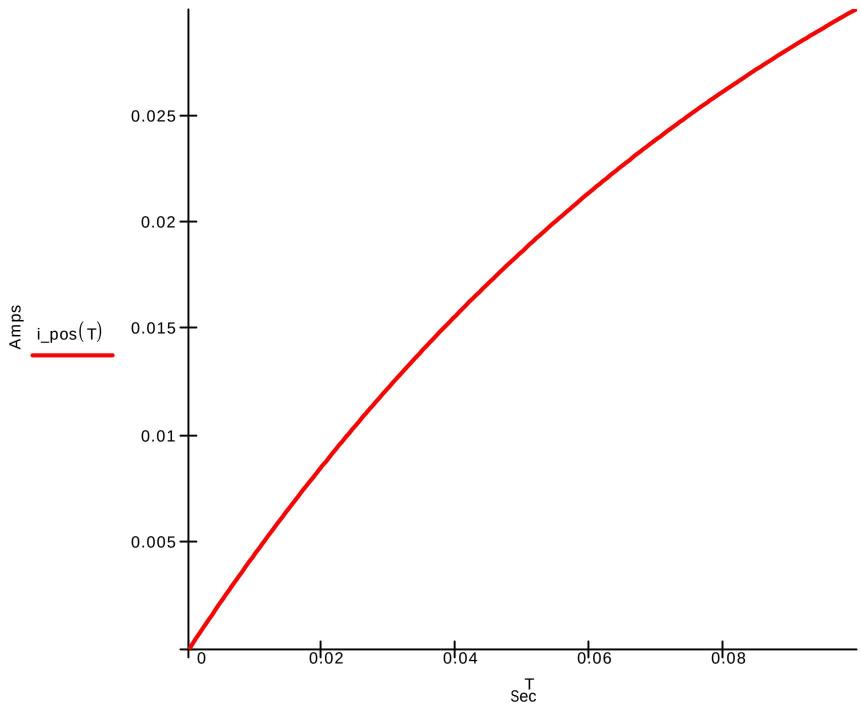

Figure 12

Add Time-Reversed Impulse Current to Time-Forward Current:

$i(T) := i\_neg(T) + i\_pos(T)$

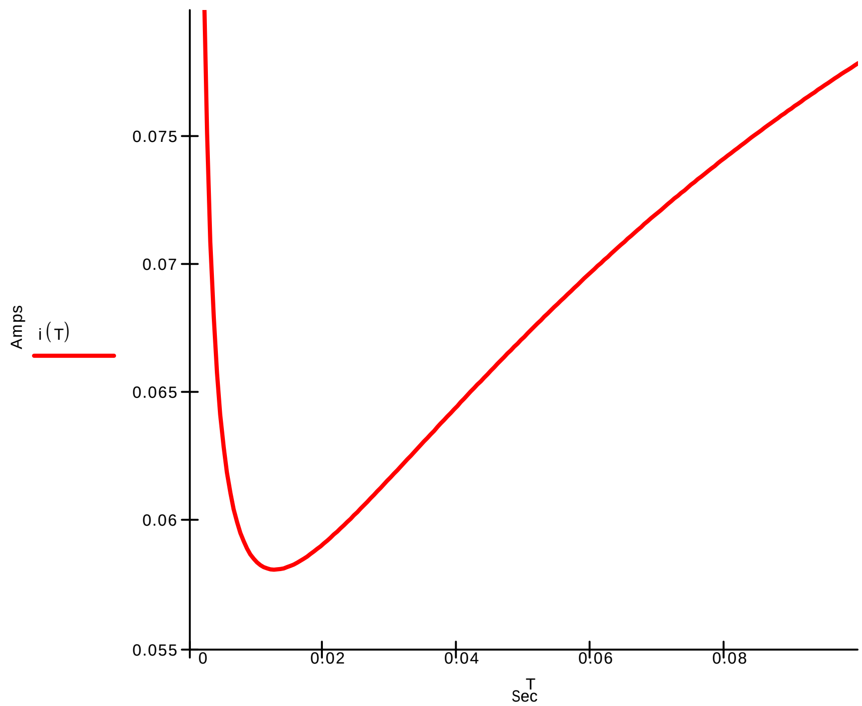

Figure 13

COMMENTS:

Referring to figure 1, the moment S1 closes (t = 0 sec), a "negative energy" impulse function occurs. This is also shown in figures 6 and 7 as a voltage impulse function.

"Negative power" is produced during the time duration as shown in figure 8.

"Negative energy" is sent back to the source as shown in figure 10.

Because the coil is resistive, it will dissipate "positive energy" as shown in figure 5. However, the total power (Pin) is negative as shown in figure 8.

Figure 9 is of special interest because it exhibits a property I call "supernegativity".