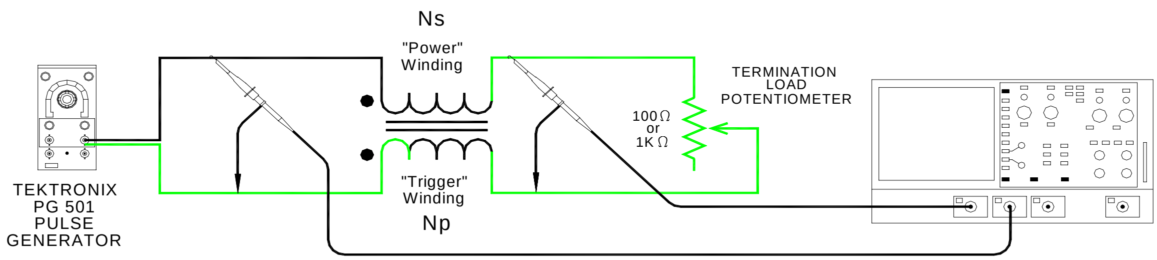
Evaluating Common FE Coupled Inductor Systems in Terms of Delay Line Parameters



DETERMINING DELAY TIME T_d & CHARACTERISTIC IMPEDANCE Z_o

Coupled Inductors are a central component in a number of established Free Energy technologies. They have been used by Robert Prentice, Marvin Cole (E.V. Gray), Eric Dollard, John Bedini, Stan Meyer, and possibly Lester Hendershot. This is in addition to the vast array of coupled inductors that Dr. Tesla employed in his decades of research. Generally, modern independent researchers approach these devices from the standpoint of classical transformer theory and tend to view their operation in this way. I propose that, in many cases, these devices were intended to be used as Transmission Lines or Delay lines to take advantage of the unique features available with this topology. This is especially important when the characteristics of a high energy sparks are being engineered to achieve fast rise and fall times (<10 nS).

Volumes of detailed technical books are devoted to this complex subject. Specific applications are numerous because so many power and information signals are carried by transmission lines of one sort or another. However, in the realm of Free Energy the function of a Delay line appears to be relatively straight forward. Its common purpose is to act as a special kind of DC charged capacitor that will quickly deliver a fixed amount of disruptive energy to a spark gap. In applications that don't involve a spark, like the John Bedini motor, it is used (among other purposes) for sharp transition pulse formation using the same principles of operation.

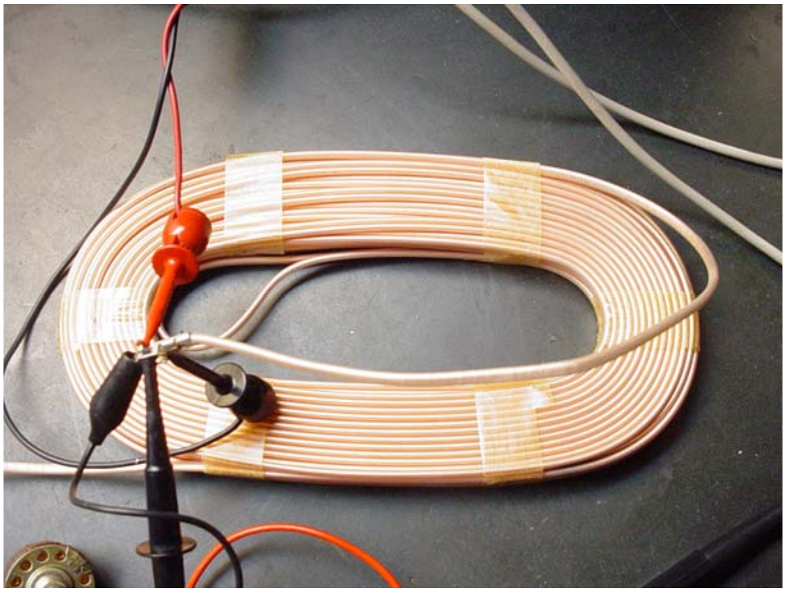
There are two measurable parameters of a Delay line which are the foundation of most engineering analysis that will involve these devices.

1) The effective voltage time delay from one end to the other, abbreviated as T_d measured in seconds

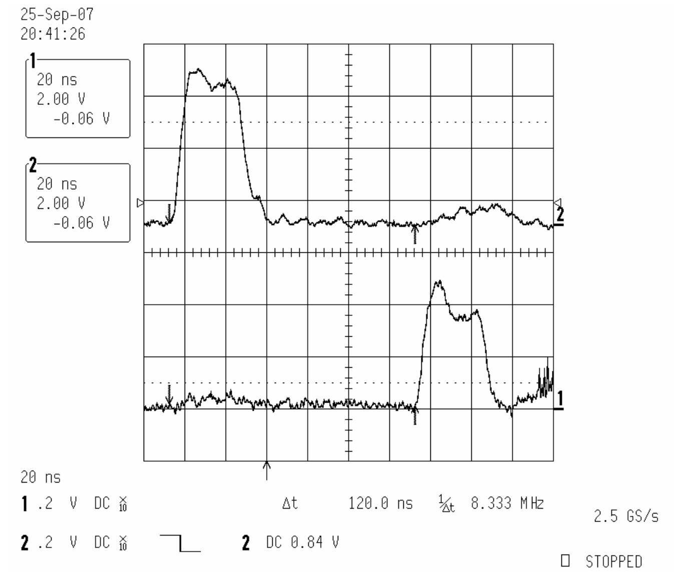
2) The characteristic impedance Z_o measured in Ohms

Both of these values can be easily measured with standard electronics equipment. This paper will utilize a LeCroy 9361 dual channel 300 MHz Oscilloscope with two standard 10:1 10 Meg probes and a Tektronix PG 501 pulse generator. A Fluke 87 VOM will be used to determine the resistance of potentiometer settings.

A good place to start this subject is to observe how a commercial Delay line functions. In this example an old 465 Tektronix oscilloscope twin-lead vertical input Delay line is evaluated. To best see its operation, the PG 501 was set to the narrowest pulse it could produce (25 nS) and applied directly to the Delay line input. A 100 Ohm potentiometer was set to 50 Ohms and connected to the Delay line output. The second oscilloscope probe was connected in shunt with the termination potentiometer.



Vertical Delay line for Tektronix 465 Oscilloscope

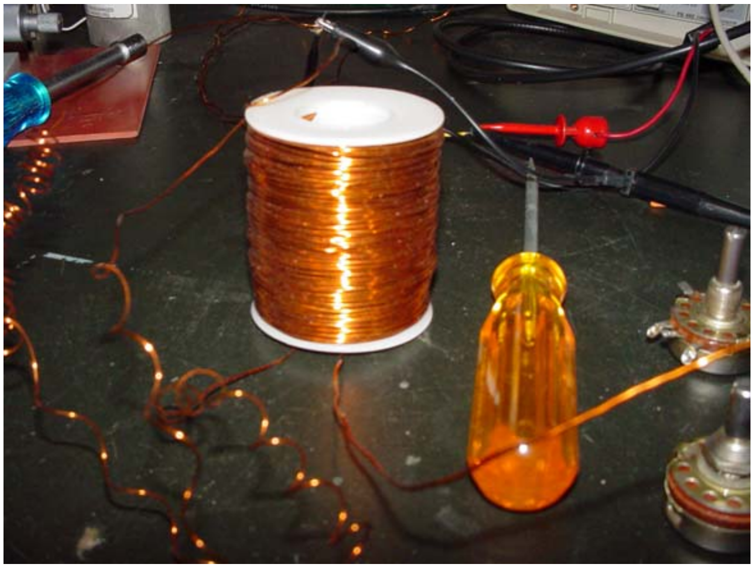


Resulting Trace using Two Probes

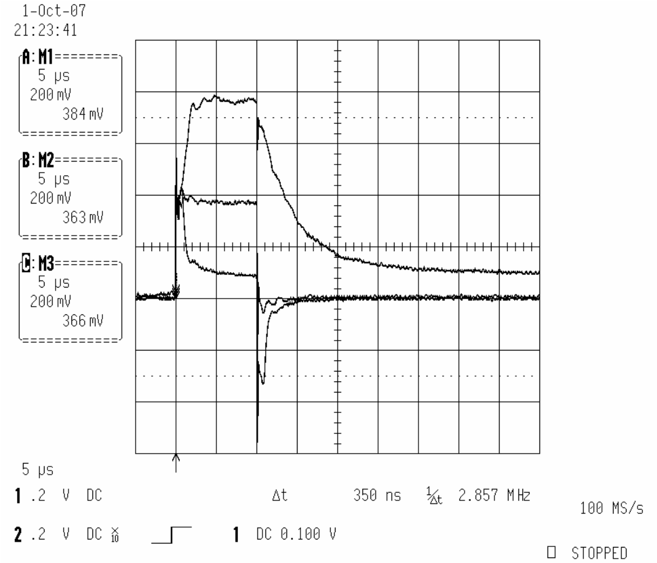
The two-channel trace from the oscilloscope (above) clearly shows the input pulse (Upper trace on Channel 2) and the output pulse (Lower trace Channel 1) delayed by 120 nS. While this straightforward approach will easily determine the delay time in a very low loss instrument Delay line, establishing delay times in homemade coupled inductors requires a different approach. If this present method were applied to most real-world coupled inductors, the output pulse will become so attenuated that it will be barely visible. The degradation of the input pulse increases as the coil under test becomes larger.

As it turns out, the energy in a 25 nS pulse is just too feeble to be observed in any homemade coupled inductor. This is because the parasitic capacitance filters out all of the high frequency components. Short pulses are just swallowed up in the unavoidable losses inherent in hand-wound inductors. However, another simple method, using the same equipment, can be employed to overcome these limitations. If the test input pulse is widened to some convenient length (to increase the applied energy) then the reflected pulse wave forms can be viewed. The actual delay time will be ½ of the observed time between the leading edge of the applied pulse and the change in response that is caused by the termination resistance.

A good example would be to make measurements on a typical Bedini SG motor coil. The coil being measured is a bifilar design using #19 AWG magnet wire for the "Power Winding" and #24 AWG magnet wire for the "Trigger Winding" with 420 turns wound on a Radio Shack wire spool. The soft iron welding rods used for the core were removed.



Typical John Bedini SG Bifilar Motor Coil



Dynamic Pulse Response

The first step is to establish the value of a load resistance R_L that will closely match the effective Z_o of the coupled inductor under test. This is done by applying a suitable pulse to the input of the Delay line (in this example we are using a 10 uS pulse) and then storing three traces:

a) Upper Trace: Delay Line is open at the output end

b) Middle Trace: Delay Line is terminated to a potentiometer adjusted to match Z_o Adjusted for “maximum squareness”

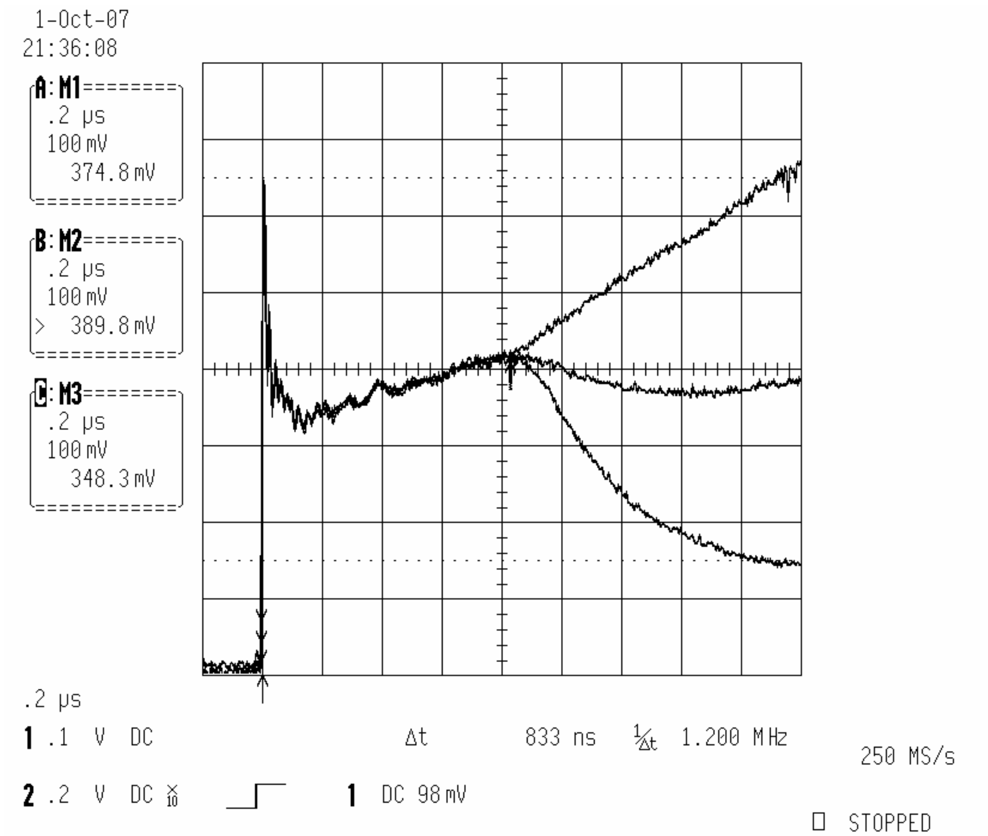
c) Lower Trace: Delay Line is shorted at its output end

What “maximum squareness” means is a matter of personal taste since there is always ringing and overshoots to have to deal with. However, when the potentiometer is close to the optimum value, small variations will make a big difference in the observed shape.

When the potentiometer is “dialed in”, it is then removed from the test bed and its resistance value measured with a VOM. In this example the result was 40.6 ohms.

If the iron welding rods are inserted into the core, no observable change is noticed in this series of measurements.

The next step is to expand our time base on the above pulse and store another three traces, following the same procedures as above.

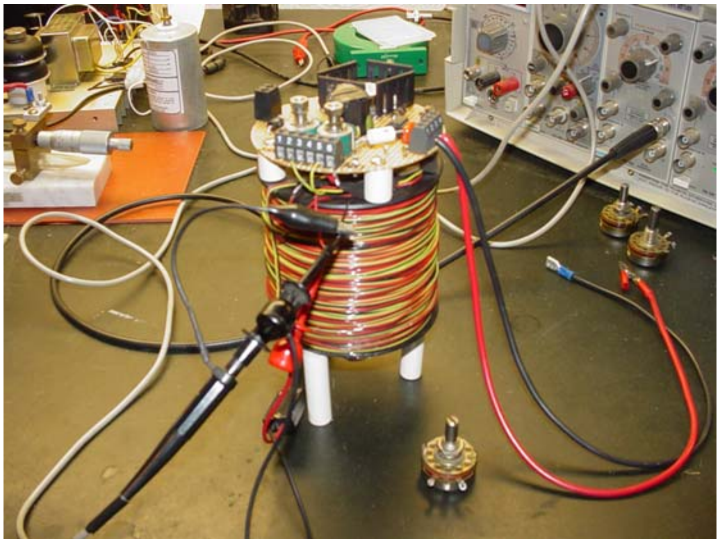


Leading edge of a pulse applied to a Bedini SG coupled inductor under three load conditions

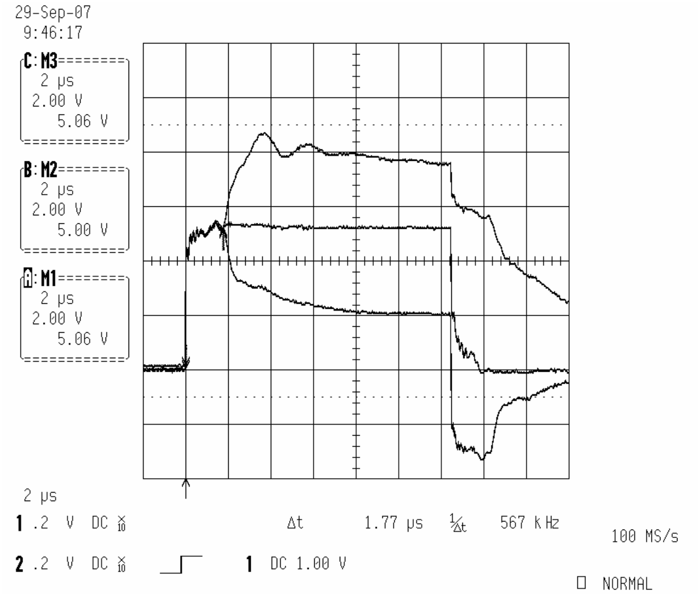
Here, the time base has been expanded by a factor of 10X to view the leading edge of the applied pulse at 200 nS/div. The upper trace is the open condition. The middle trace is done with matched Z_o loading and the lower trace is the shorted condition. All three of these waveforms converge at one point. This point establishes how long it takes the applied pulse leading edge to travel to the end of the coupled inductor and return. The kind of load it finds attached at the end, then determines how it will respond from there on.

Measuring the time between the leading edge and this intersection, then dividing by 2 we arrive at the one way Delay Time for the coupled inductor under test. For this Bedini Coil we measure a T_d of 415.5 nS.

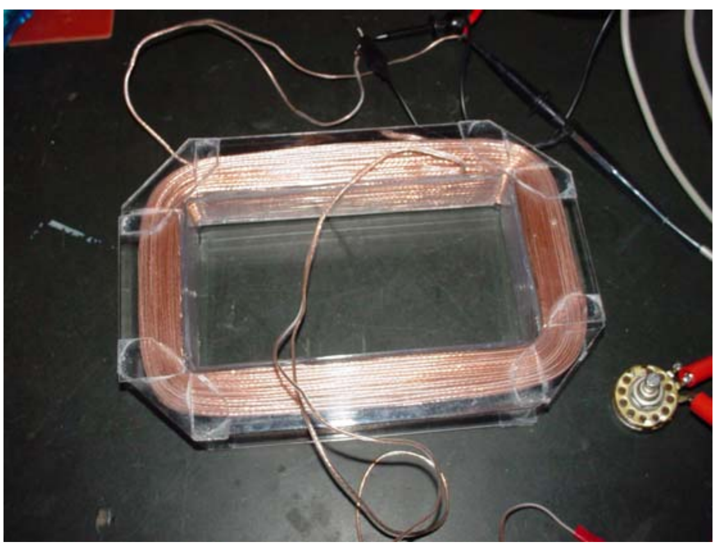
With this procedure we can go on to evaluate other kinds of FE coupled inductor systems:



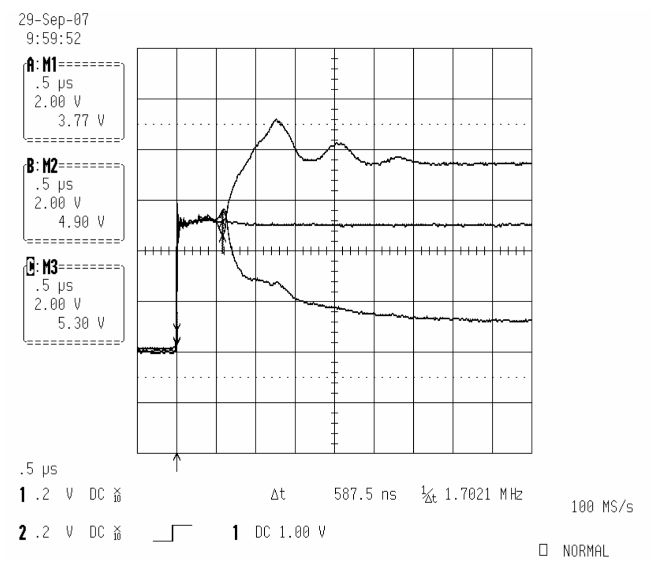
The Trifilar Lindemann Coil – 1000 Turns



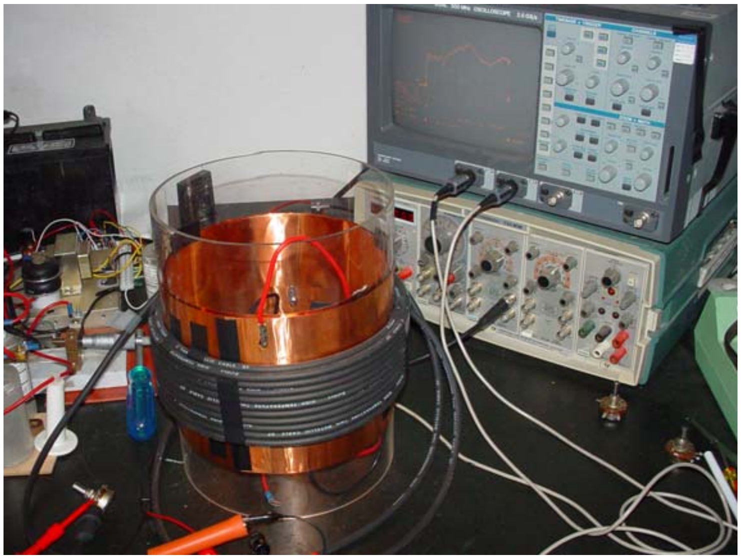
Z_o = 108 Ohms T_d of 885 nS.



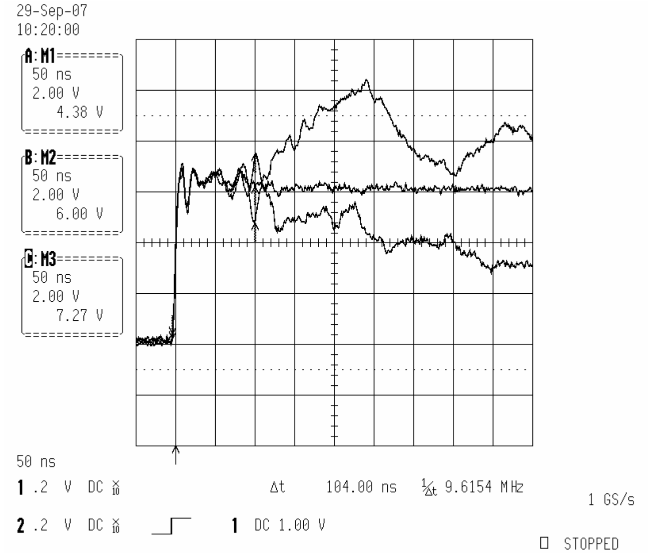
The Mike Motor Coil – 100’ #22 Speaker Wire



Z_o = 112 Ohms T_d of 293 nS.



50 KV 8” Prototype Cole FFF



Z_o = 180 Ohms T_d of 52 nS.