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Abstract

This short paper describes a simple method how to build a lenzless resonant transformer. Lenz law is not violated but it is used to create more efficient transformer. Without Lenz law this setup could not work.

First some simple tests are presented which forms foundation of the device. Then based on the results of these tests I built the transformer which confirmed my test results. It is important to understand the method which will give you understanding. When you understand it you can build it using different components compared to what I used.

1 Effect of capacitors in resonant LC-circuits

Capacitor's value in parallel resonant LC-circuit controls the attenuation level of band-stop filter. Low value of C makes the resonant area smaller and attenuation steeper. High value of C makes resonant area wider and attenuation level lower. When playing with resonant effects it is wise to start from high value of C. I used 440 nf to 2000 nf.

In series resonant LC-circuit frequency response has a notch at resonant frequency. Frequency response is the opposite of parallel LC-circuit.

To get maximum effect it is therefore best to have high attenuation level at primary parallel LC-circuit (low C) and high amplification level at secondary LC-circuit (also low C).

Q-factor is the inductive reactance of the coil divided by DC resistance of the coil. Q-factor determines the resonant rise in the resonant circuit so higher the Q factor higher the power output. DC resistance can be minimized using thicker wire and less turns. Inductive reactance can be maximized using higher resonant frequency which is controlled by the L and C of the circuit. Smaller L and C increase resonant frequency.

There is plenty of information about Q-factor in the net, I just wanted to put short intro here so that you understand that a high Q resonant LC-circuit can be dangerous.

2 Two kind of inductances

Simple solenoid wound on a core affects only to another solenoid below/over it. If two solenoids are put next each other they have little effect. Lets call this is local inductance field.

Coil on a closed loop core affects any coil within the same loop and it has much higher inductance than solenoid. Does this mean that local field disappears ? No, it doesn't. This effect can be used to make a simple over unity device.

3 Testing of closed loop cores

I used E parts from low power iron laminated transformers and put the E parts together. I placed primary coil of high very high inductance and put AC through it. The E plates snapped together and stayed that way even after power was disconnected. I tried several times, sometimes force was strong and sometimes they did not stick. Its strength clearly depended on the input AC waveform. When I separated the E plates they no longer stayed together, so something was interrupted in the core. While cores were together they were not magnetic. Another iron would not stick to core. This is Ed Leedskalnin's perpetual motion holder, PMH.

Conclusion: There is something moving inside the core and it has zero resistance. Lets call it magnetic current.

Then I put three similar coils in the core, one got load and others were idle. There was same voltage at both coils of course. Shorting one output coil and power began to flow in the primary and at the same time voltage dropped to half in idle coil. Following seemingly unimportant but obvious conclusion can be made:

Conclusion: Secondary coil also creates magnetic current and different secondary coils affect each other in opposite way.

Next I connected various points in the core with iron. Points that I used for testing are shown below.

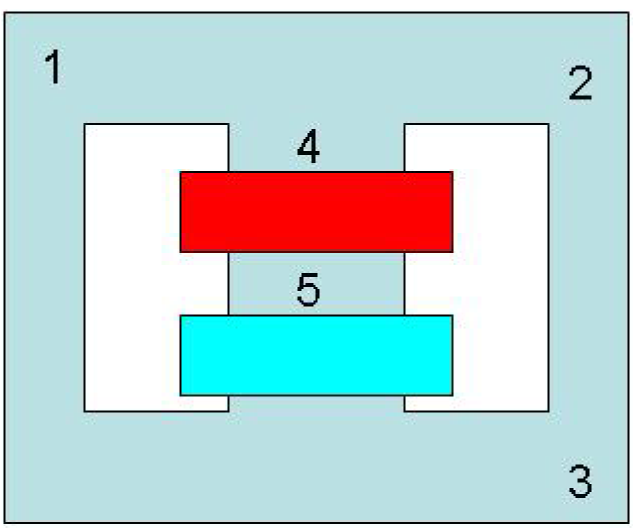

Figure 1. E-I core with coils and probe points.

When iron was connected between points one and two there was no effect. When connected between points two and three there was a notable effect: a sound and sort of vibration when iron approached the core which seized when both ends touched the core. When connected between points four and five there was same effect but stronger. In this case power output of the core dropped while power input remained the same.

Conclusion: Magnetic current inside the core wants to loop back to itself through every possible route it can. This is quite opposite of electric current which always tries to find the path of least resistance.

For next test I used nanoperm core, wound about 50 turns for primary and secondary. Primary got AC from output of audio amplifier and secondary was connected to loudspeaker. Then I played some music from my PC that was the source to the audio amplifier. I heard the music and higher frequencies were attenuated while lower frequencies sounded fine. What I got was a low pass analog audio filter.

Conclusion: There can be all frequencies active in the output coil at the same time. Hence there can also be magnetic current active at the same time at all frequencies in the core.

Based on these simple tests I then reached the following result:

There runs magnetic current in a looped core which varies with time when core is energized using AC electric current. Magnetic current has summing/subtracting properties and it also has a perpetual motion property. It can be modeled as a sine wave and sine waves can be manipulated to our advantage.

4 Using two inductances in a resonant LC-circuit

Below pictures of C-I and E-I cores that shows how coils should be wound. All coils are wound in the same direction and connected from the ends. When coils are used like this their closed loop magnetic currents cancel each other and only local inductance field remains. This is why there is a resonant frequency but much higher than otherwise possible. For example, I used two 160 turn coils and resonant frequency was between 12-13 kHz. One coil of 20 turns in my nanoperm core blocks everything above 1.5 kHz. And I can push 260 watts from my audio amp !

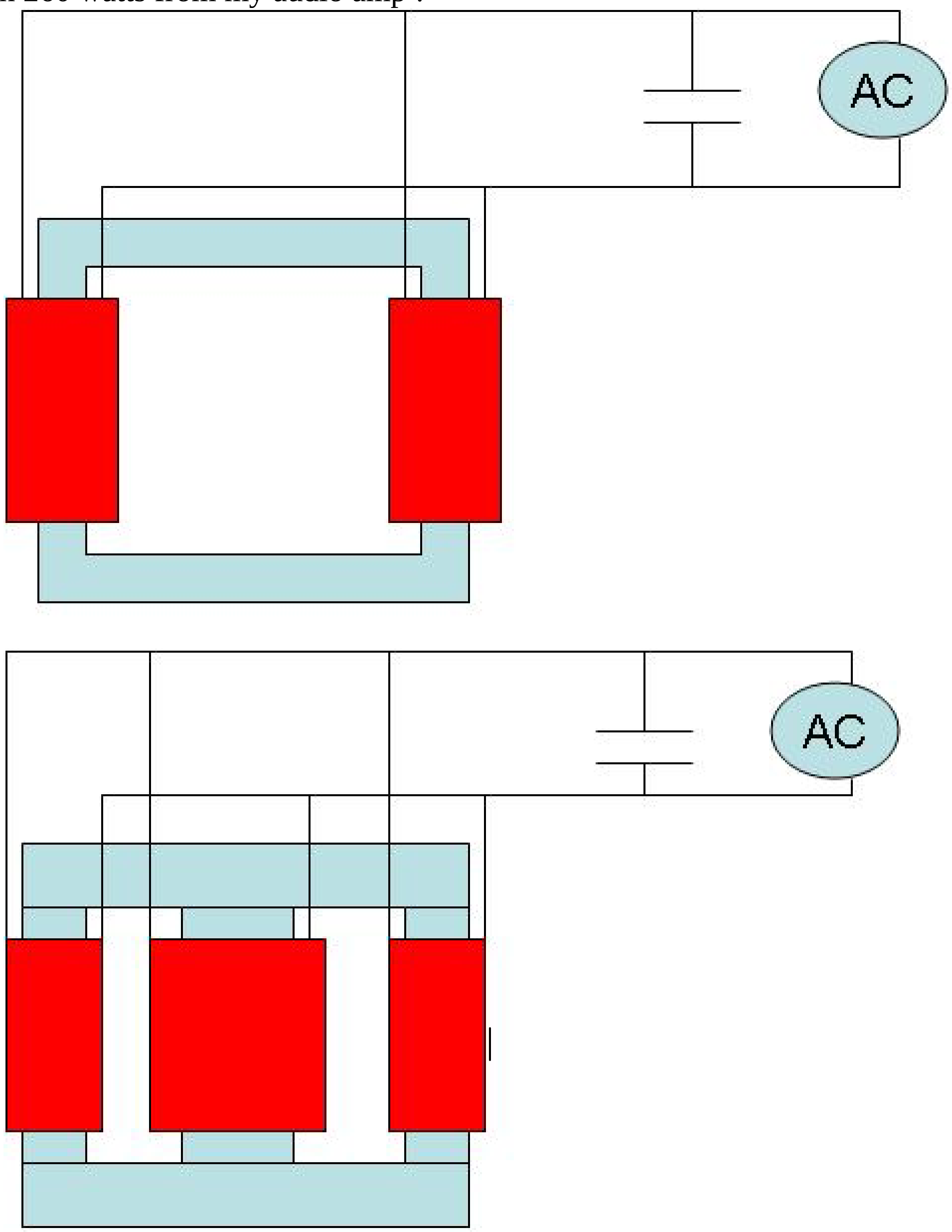

Figure 2. C-I and E-I resonant setup.

Now you may think that this is of no use. If there is a pickup coil then it will not catch anything as magnetic currents inside the core are cancelled. But if these two coils are used as outputs and they are driven by a primary wound over both of them then result is that power is generated. Both outputs will then be in exact same phase and when connected correctly they amplify each other while the primary circuit does not see a thing as opposite phase magnetic currents cancel each other out. See figure 3.

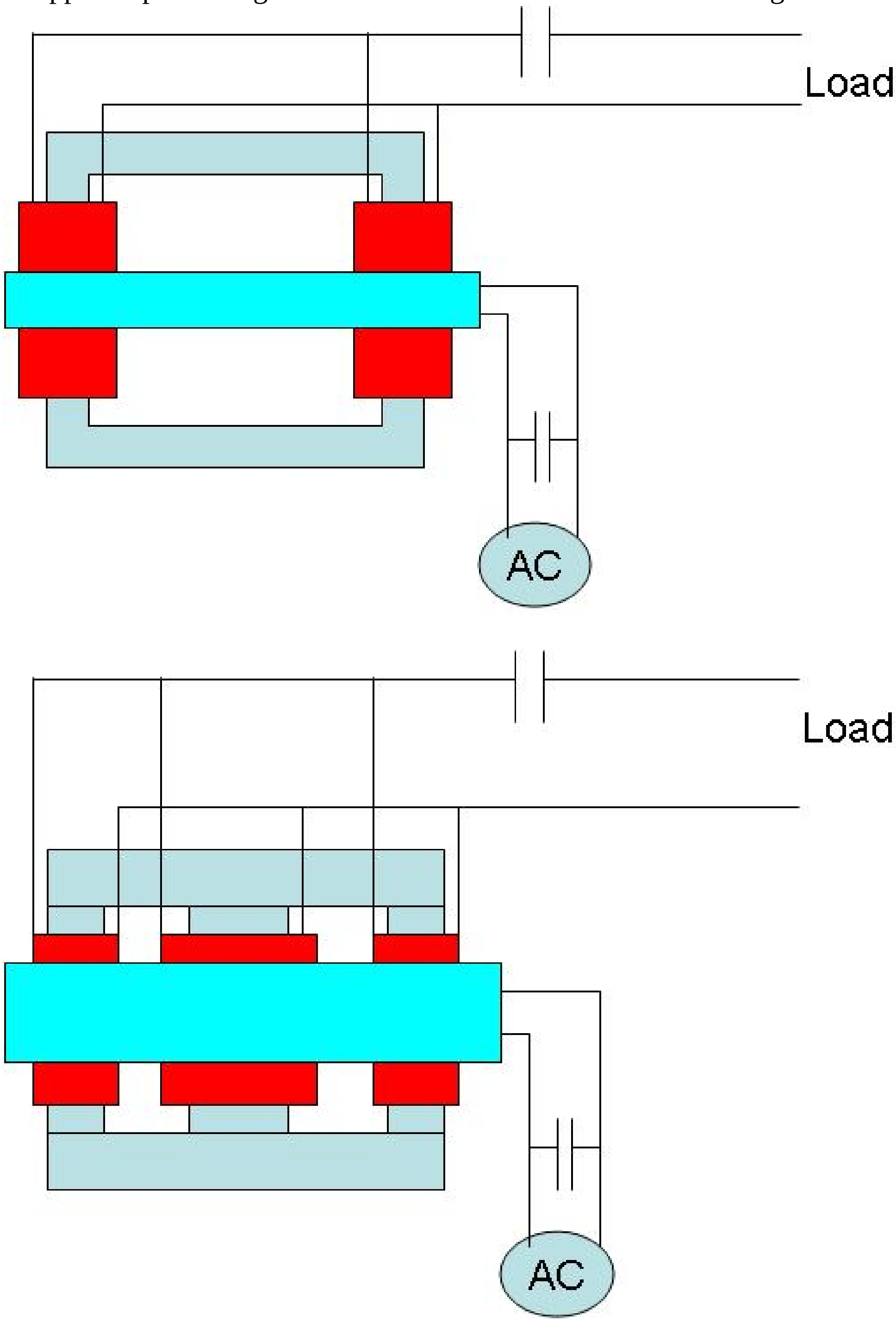

Figure 3. C-I and E-I with primary on top.

Now you realize that the primary coil is in fact a solenoid, it has no magnetic loops and it has low inductance. Secondary coils form closed loops and they have higher inductance. The more secondary coils are used, the more magnetic current in correct phase will be circulating inside the core. Don Smith called this resonant magnetic flux.

Thick multi strand wire (not Litz type!) should work best, few turns and a capacitor. But any thickness of wire will off course do.

Warning: Begin using small wires, something below 0.5mm. I haven't tested thick wires but there occurs resonant rise. Better start from low Q resonant circuits, you don't want kilovolts occurring near you.

Tuning is now easy. First you make parallel LC-circuit from secondary coils, see figure 2. You can use toroid shape, C-I or E-I. E-I should be most efficient. Next find its resonant frequency. Now disconnect secondary coils and do the same for your primary coil. Adjust the number of turns in the primary coil or amount of capacitance until you get close enough frequency with found resonant frequency in the output.

Now connect the load and feed the primary coil with pure AC sine wave so it reverses directions. Pulses do not work because pulse contains all frequencies which in turn create magnetic current at all frequencies resulting in a total mess in the core. Input has to be pure sine wave.

There has got to be amps running in the primary LC-circuit so that the primary capacitor is filled. If you get resonance but see no power then try to use higher frequency.

If you use E-I or C-I type cores, make sure that there are no air gaps. There has to be closed magnetic circuits in the core. Using LED as load obviously does not work because it prevents resonant rise in the output LC-circuit. I suspect that E-I works best when core dimensions are such that core area in the middle leg is two times bigger compared to outer legs. Magnetic currents created by the secondary coils should be equal so that their sum is always zero.

Permeability of the core does not matter and you can use iron or ferrite. You need to use frequency that is within limits of what the core material can handle. Nanoperm that I used can handle frequencies up to one MHz.

5 My results

My input source was audio amplifier, I guess it outputs power at 5 volts, no idea really. I cannot measure it as I have no meters. I used GoldWave audio editor to create sine input. It has a nice expression evaluator that allows to do frequency sweeps easily. GoldWave is a free software available from www.goldwave.com.

I used M-088 nanoperm core from Magnetec (u was 80000) with 0.3 mm wire. First I had about 160 turns in each secondary and 20 meters wrapped in the primary, about 120 turns or so (way too much but that was my initial guess). I had to use high number of turns because my input was limited below 20 kHz. I was lucky to find suitable L and C combinations so I could see a glimpse of the resonant action.

Since I don't have any meters I used halogen bulbs. I got 5W 12 volt bulb in the primary and 10 W and 8 W 12 volt bulbs in the output. I did a sweep and as the frequency went through the sweet spot output power increased. At resonant frequency somewhere between 12 - 13 kHz there was no light at all in the primary halogen but output bulbs were about half brightness.

Now that I got it, I reduced the number of turns to half in secondary coils and changed capacitance from 440 nf to 1000 nf. Resonant frequency at output changed a bit but since the resonant area was wide it did not make notable difference. Now I got more light, almost full brightness and halogens were way too hot to touch. Again no light visible in the primary side.

So what did I just do ? DC resistance dropped to half in output coils so Q factor of was doubled giving double resonant rise in the output LC-circuit. Cool!

I observed the same action in the primary LC-circuit. There I used 40 meters of wire on primary and I got much less power out. In this case Q-factor dropped to half which explains it nicely.

6 Things to try after successful replication

Bifilar windings, they should lower total value of L so higher resonant frequency can be used. At the output there could be bifilar windings without capacitors because high voltage capacitors are expensive and dangerous when loaded. Then place a correct capacitor in primary LC-circuit to tune in.

7 Tuning test

I don't know if this will actually work because I was unable to test this but I put it here as an idea anyway.

Problem: How to tune the two resonant circuits perfectly ?
Answer: Remove load and short the output coil so that there is only the parallel LC-circuit. Then put a small tuning capacitor in the primary side parallel to resonant capacitor. Now feed the primary with resonant frequency that you have found earlier and adjust capacitance with tuning capacitor until current consumption from the source is minimized.

8 Disclaimer

I made this is for information purposes and anyone is free to use this information as they please. Be aware that resonant circuits can be dangerous as there is high voltage involved when resonant rise occurs. If you do not fully understand what I have written then do not attempt to try this, let others do it.

I will take no responsibility of your actions.

I have done some tests and shown potential dangers but of course it does not mean I am aware of all dangers. So should you decide to try this be careful at frequencies above 20 kHz and when using wires thicker than 0.5 mm. Always better to start from low power levels and gradually increase power output. Could even be that there is no danger at all because there is a load in the output circuit which might prevent overrun condition. I have not tested if this is a fact.

Discussion thread (also where this pdf can be found from) is at
http://www.overunity.com/14211/lenzless-resonant-transformer/new/#new