Fast Transient Bucking Coils produce Clockwise Loop

Osamu Ide's OU converter uses short pulses, which suggests that magnetic propagation delay may have something to do with its performance. The claimed "forward EMF" being in the same direction as the current is simply another way of saying negative resistance, i.e. it represents an energy source. The diagrams show this "forward EMF" region being a narrow spike within the waveform. It is well known that for inductive systems an energy source is represented by a clockwise BH loop, which is really a material characteristic where the area of the loop is an energy density. At the system level a clockwise Φ v. I loop is an energy source where the area of the loop represents energy. It is shown here that bucking coils as used by Ide can produce that CW ΦI loop.

When the two bucking coils are energised simultaneously there will be a short period of time where the magnetic wavefronts propagate along the ferrite core but have not yet reached the opposite coil. This has been illustrated here by simply taking a FEMM plot and truncating it to represent the moving wavefront from one coil.

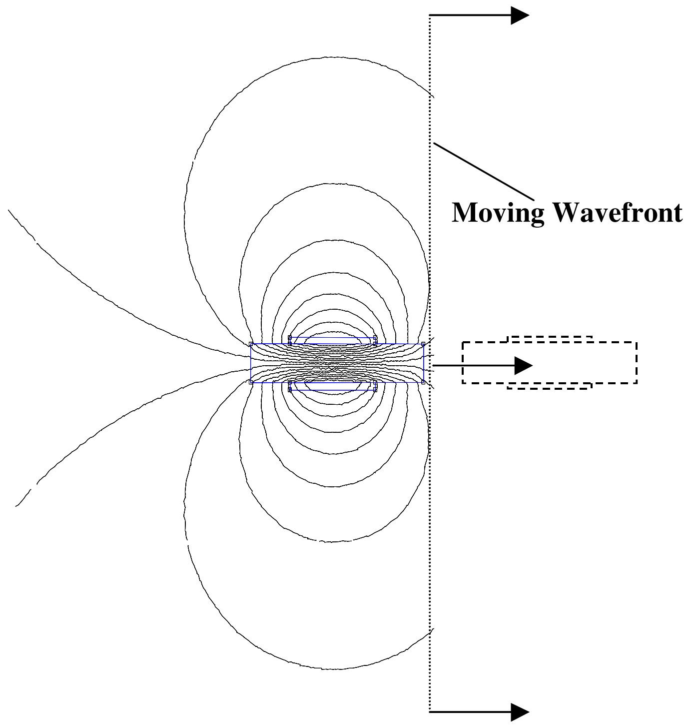

Figure 1. Magnetic Wavefront.

Of course the magnetic field from the RH coil also has a wavefront moving from R to L towards the first coil. The important thing to note is that during this time the drive source is seeing just two non-interacting coils. When the wavefronts finally reach the opposite coils then the combined inductance reduces because of their bucking interaction. This change of inductance during the applied pulse accounts for a CW loop as shown in the next figure. Here it is assumed that the coils are suddenly connected to a low impedance voltage source, hence the dΦ/dt and dI/dt are held constant by the applied voltage. Initially these rates are low according to the initial high value of inductance, then the rates increase when the inductance becomes lower. Upon removal of the voltage the inductor discharges into the load resistor, again initially at high inductance then followed by low inductance. It is seen that the ΦI chart traces a CW loop.

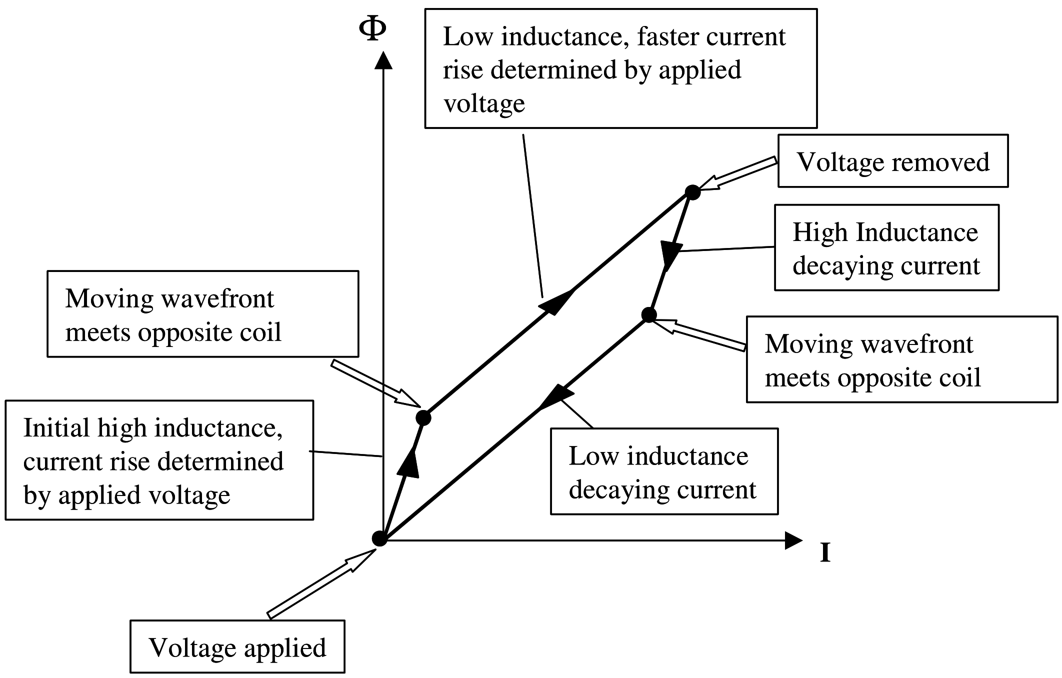

Figure 2. Phi v. I Loop

For many years I have searched for means for producing CW loops and this looks to be so easy that maybe there is a catch in it. But it seems from Ide's work that this is exactly how his system operates, so we could be onto something good here.

If we construct simplified voltage and current waveforms we obtain the following.

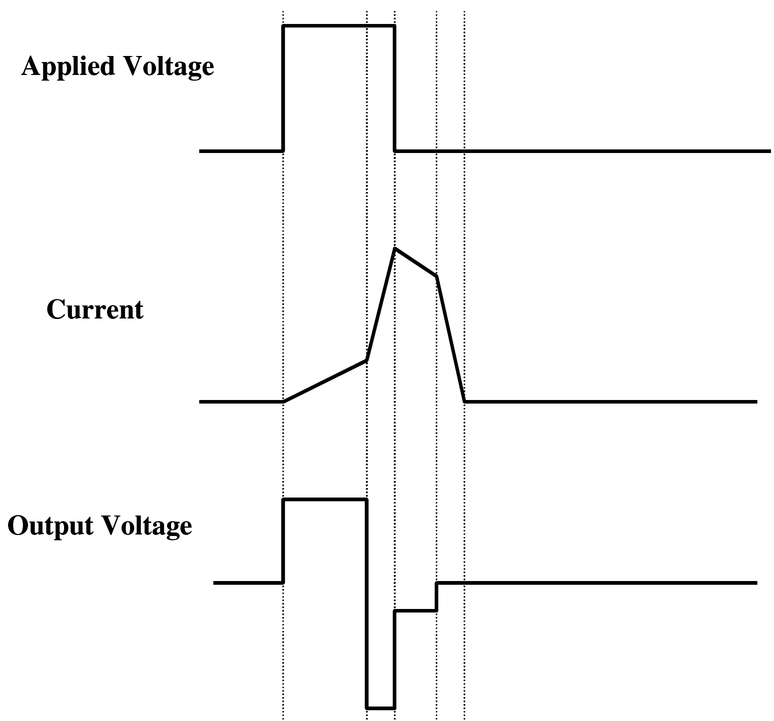

Figure 3. Voltage and Current Waveforms.

For comparison here is the waveform as given by Ide at the SPECIF conference

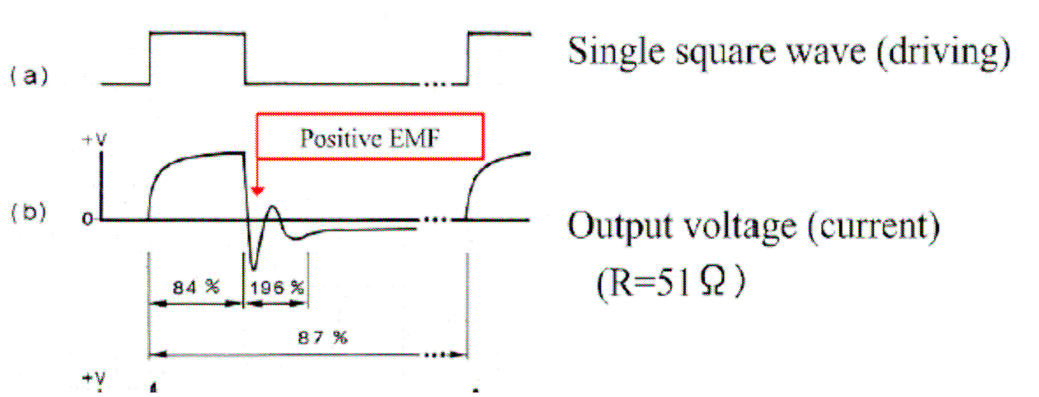

Figure 4. Ide's Waveform

The claim is that the fly-back spike is "positive EMF" whereas it represents the excess energy gained from the CW loop.