Analysis of Graham's Magnetic Implosion Transformer

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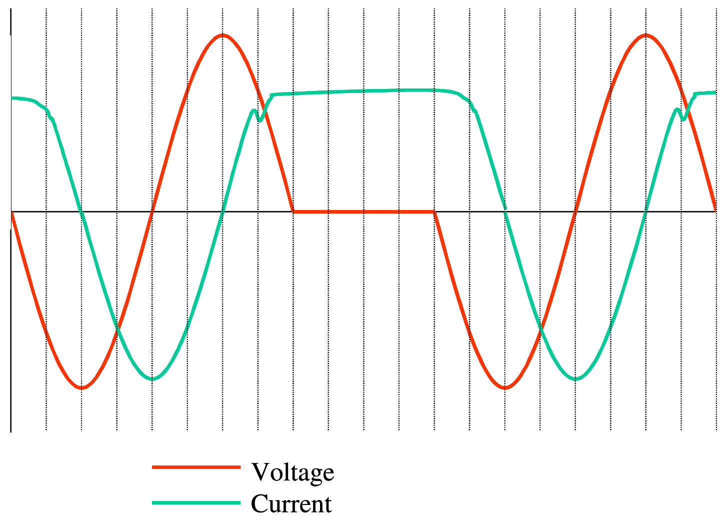
In order to understand things better I have roughly transcribed the waveforms supplied by Reiyuki onto a chart as shown here.

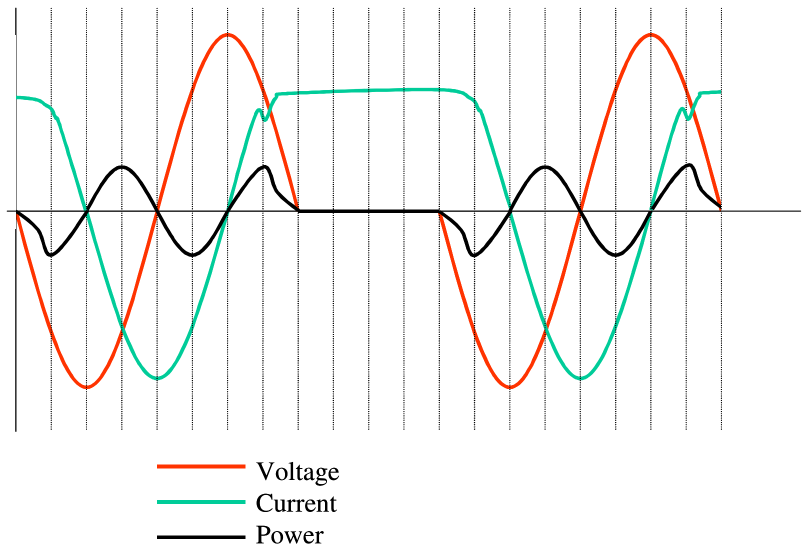
INPUT WAVEFORMS



For those wondering how current can be flowing during that part of the waveform where the voltage is zero, a low impedance voltage input that is not turned off by opening a switch but instead maintains its low impedance while the waveform is held at zero is just like a short across the winding. And a short will hold the current at a level that decays over the L/R time constant. It looks like Graham's L/R is long compared to that voltage off time interval.

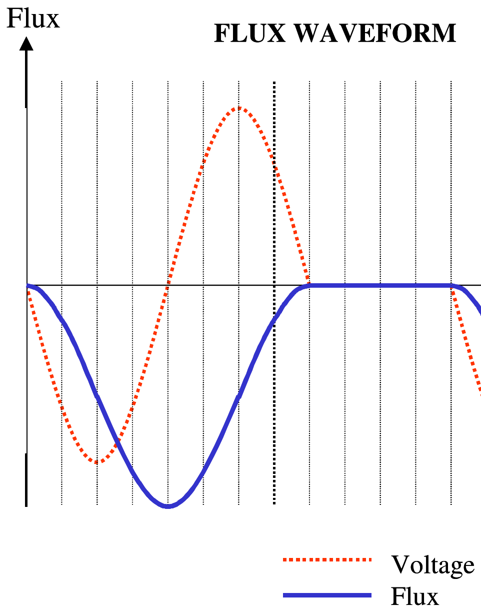
Assuming the zero line applies to both waveforms it is possible to multiply the voltage and current to get a power waveform, again done roughly by eye.

INPUT WAVEFORMS

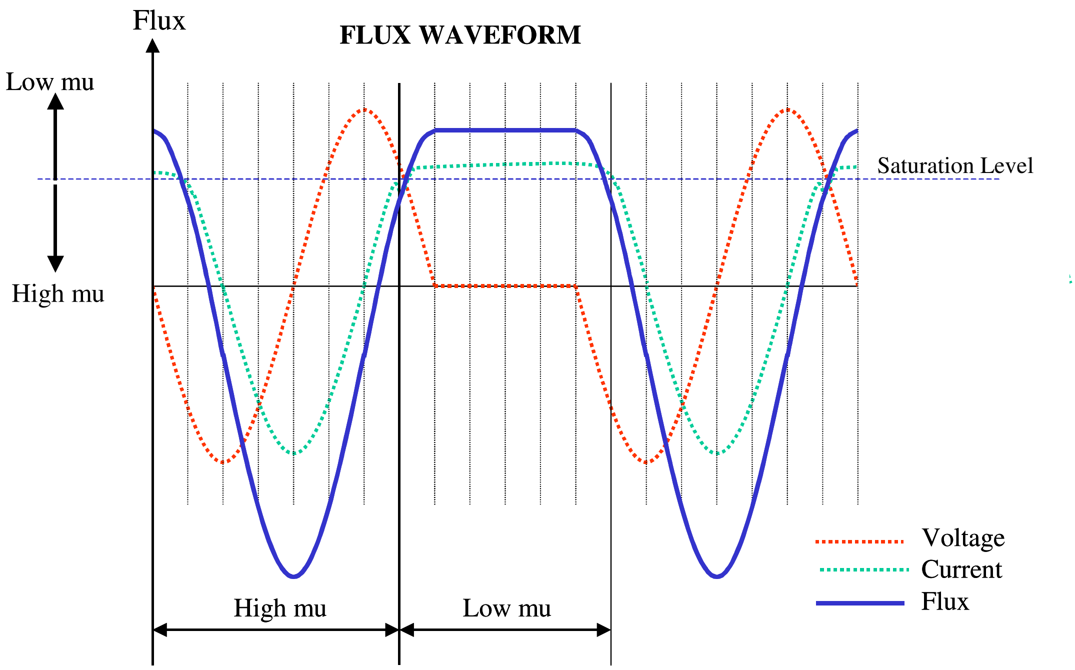


It is seen by the symmetry of the power waveform that the average input power is near zero, which is what was demonstrated.

It is possible to use the voltage waveform and obtain the flux by integration. This has been done (again roughly by eye) to get the flux waveform shown next.

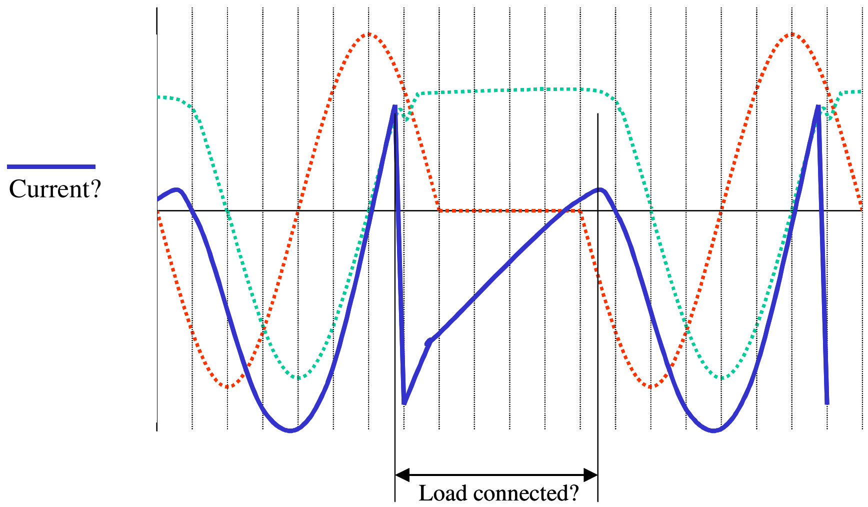


The absolute level of that waveform is determined by the static bias from the magnets, and of course in the above chart the scale is also arbitrary. By comparing the flux with the current waveform it is possible to get some idea of the position of the knee in the BH curve, as shown in the next chart.



The saturation knee has been set to coincide with the current level at the kink in the current waveform. If the core material were linear the ratio of flux to current either side of this line would be a constant value, but clearly this is not the case. It seems that above that line the material has lower mu, has moved into saturation, while below that line the material has higher mu, below saturation. This now offers an interesting possibility. In the high mu region, at high inductance, the system has produced current at virtually zero power loss because of the phase quadrature. Note that during this period there is no load on the secondary to consume power. At the point where the current has driven the core into saturation the voltage waveform is switched off, but the low impedance input holds that current. That current has flux associated with it, and that represents magnetic energy. Now we have the possibility of extracting that magnetic energy by suddenly switching in a load on the secondary. The secondary load has to then be present up to the next starting point, i.e. as shown in the next chart. This shows the output current waveform and the load switch region.

OUTPUT WAVEFORM



I have to admit to being completely baffled by this waveform since it is showing current outside the load connected region. Without having access to the circuit and exactly what was measured I cannot take this any further.