The Gunderson-Smith Effect
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1. Introduction

Graham Gunderson exhibited his “Magnetic Implosion Transformer” at the 2016 Energy Conference. This device apparently delivered more power out than was supplied. Gunderson admitted that he did not know why this was so, he had discovered the effect by accident while experimenting. He did demonstrate waveforms pertaining to input and output, along with a computed waveform of the flux through the secondary. The input waveform was of a special form and the transformer output was converted to DC using synchronous rectification that effectively produced a very short interrupt during which the flux changed sharply. This paper presents an effect that could explain why Gunderson's device gave those results. Because of its importance in offering means for extracting energy from ferromagnetic material it has been given the special name “The Gunderson-Smith Effect”.

A significant feature of the transformer is the rapid change of flux during the secondary interrupt period. This suggested two avenues of enquiry, one being the possibility that energy could be stored in the compression of the mylar film situated between the two core halves, and that mass inertia might play its part in slowing down the change in compression when the flux changes value. During the slow flux change between secondary interrupts the compression would follow the flux, but in the fast flux change period the core faces would not move hence creating an imbalance between the magnetic energy and the stored compression energy. After exploring this in some detail it has been found that this imbalance does not lead to over-unity.

The second possibility relates to the frequency response of the core material where its permeability can have different values for different rates-of-change of flux. This is much more rewarding and the following sections explore this in more detail.

2. Permeability characteristics

Figure 1 shows the complex permeability characteristics of ferrite PE22. Quite clearly there is a resonance at a frequency near 1MHz where the real value μ' shows a sharp peak.

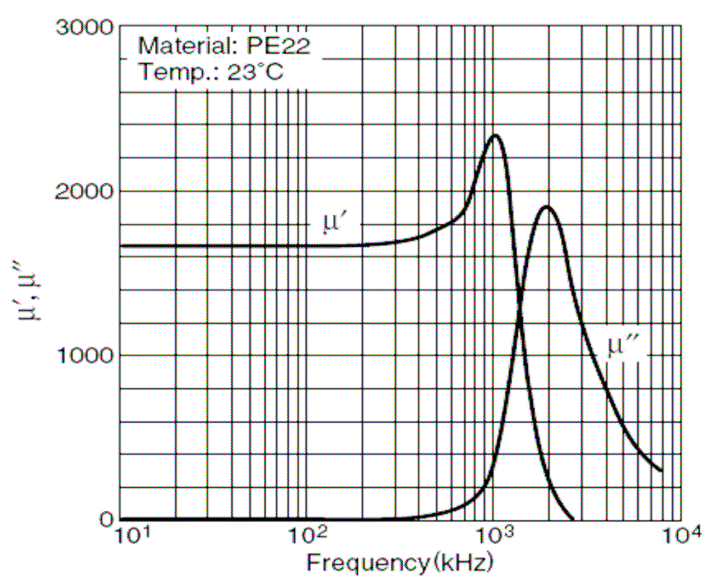

Figure 1. Complex Permeability of PE22.

The imaginary value μ" peaks at about 2MHz. This behaviour is due to a ferromagnetic resonance in the core material at a frequency close to the peak value of μ". Caltun et al [1] give formulae for permeability taken from Nakamura [2] where the rises in μ' and μ" are related to a domain wall resonance near 2MHz. This topic is dealt with in my paper [3]. Of interest here is the possibility that energy can be gained from resonantly charging an inductor at a low frequency where the permeability μ' is about 1680, then discharging it at 1MHz where the permeability is about 2320. When this sequence is plotted on a B v. H chart, or a Flux v. current chart, we get a hysteresis loop that is traversed clockwise, as depicted in figure 2.

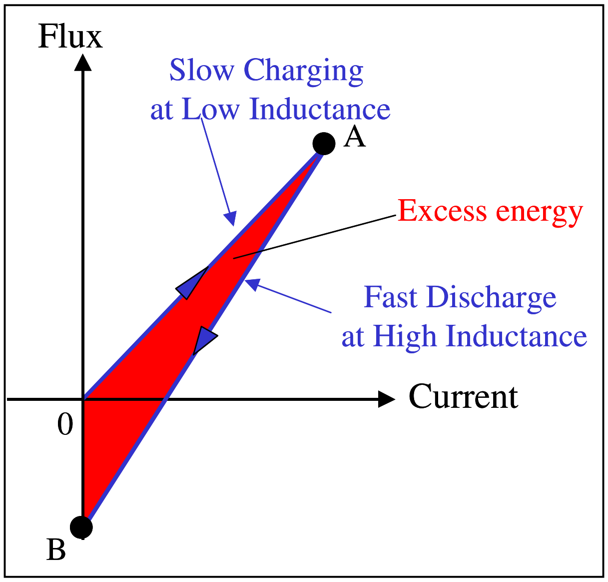

Figure 2. Clockwise Hysteresis Loop.

On the Flux v. current chart the area of the loop represents energy gained per cycle, and the question must be asked, does this energy exceed that which is lost to core losses as determined by the imaginary component μ"? If so can the area of the CW loop be increased by some means? One possibility for an increase in the CW loop area is to operate in a region where the permeability is non-linear, i.e. near the saturation of the core. This is illustrated in figure 3 for the same ratio between LF and HF permeability.

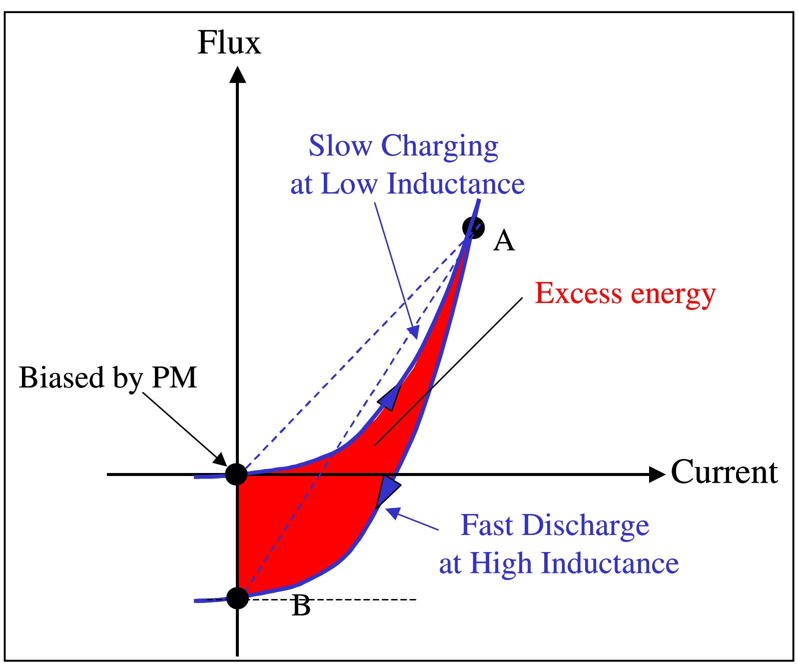

Figure 3. Increased Loop Area.

Clearly the area in figure 3 is greater than that of figure 2, so maybe Gunderson discovered this means of obtaining over-unity. The ferrite material used by Gunderson is not known, but he did use two different materials for the two U core halves. It is likely that the HF ferrite used in the top part of the transformer did exhibit this domain-wall ferro-magnetic resonance. He uses magnets applying cross flux to that part of the core that would restrict flux flow by increasing the reluctance, and that would make it easier for his top magnet to bias the core at the optimum position just above saturation.

3. Other Materials

Clearly the ratio of the peak μ' to the low frequency μ' indicates the ratio of inductance, hence energy gain. At that peak point the ratio of μ" to μ' indicates the energy loss during the fast transient (the loss during the slow transient is negligible). A selection of some of the promising ferrites is given in the table below, along with these ratios. The final gain figure given indicates the potential for overunity performance.

Ferrite	LF	HF	Energy gain	Energy Loss	Gain
PE22	100KHz	1MHz	138%	12.9%	125.1%
4E2	10MHz	150MHz	100%	8%	92%
4D2	1MHz	10MHz	33%	4%	29%
4B3	1MHz	4MHz	23%	11%	12%
3F5	100KHz	2MHz	26%	24%	2%
3F45	100KHz	2MHz	22%	4%	18%
3F3	100KHz	1.5MHz	30%	30%	0%
3C91	100KHz	750KHz	33%	7.5%	25.5%
3C81	100KHz	700KHz	15%	9%	6%
3B46	100KHz	500KHz	29%	10%	19%

The PE22 ferrite is outstanding, but with figures plucked from a single graph from the manufacturer's data sheet this may be misleading, the graph might have been produced with some artistic licence. The low μ' ferrites show significant promise, especially 4E2, but that is a special one mainly produced for particle accelerators and unlikely to be available. 4D2 should be readily available, it has a LF μ' of only 60, but operating at higher frequency it could produce greater power than the lower frequency ones.

4. Conclusion

Gunderson's "Magnetic Implosion Transformer" could be a means of using the permeability peak created by domain wall resonance to create over-unity performance. If so it is an over-complicated method of producing the flux changes needed, relying as it does on specially conditioned primary and secondary currents. In view of the importance of this route to over-unity it is intended to create a separate thread on overunityresearch.com exploring this in more detail.

References

[1]. O.F Caltun, L. Spinu, Al. Stancu, L.D. Thung, W. Zhou, "Study of the microstructure and of the permeability spectra of Ni-Zn-Cu ferrites". Journal of Magnetism and Magnetic Materials 242-245 (2002) 160-162

[2]. T. Nakamura, J. Appl. Phys. 88 (2000) 348

[3]. Cyril Smith, "Complex Permeability Modelling".