Influence of Size and Geometry on Magnetic Core Losses

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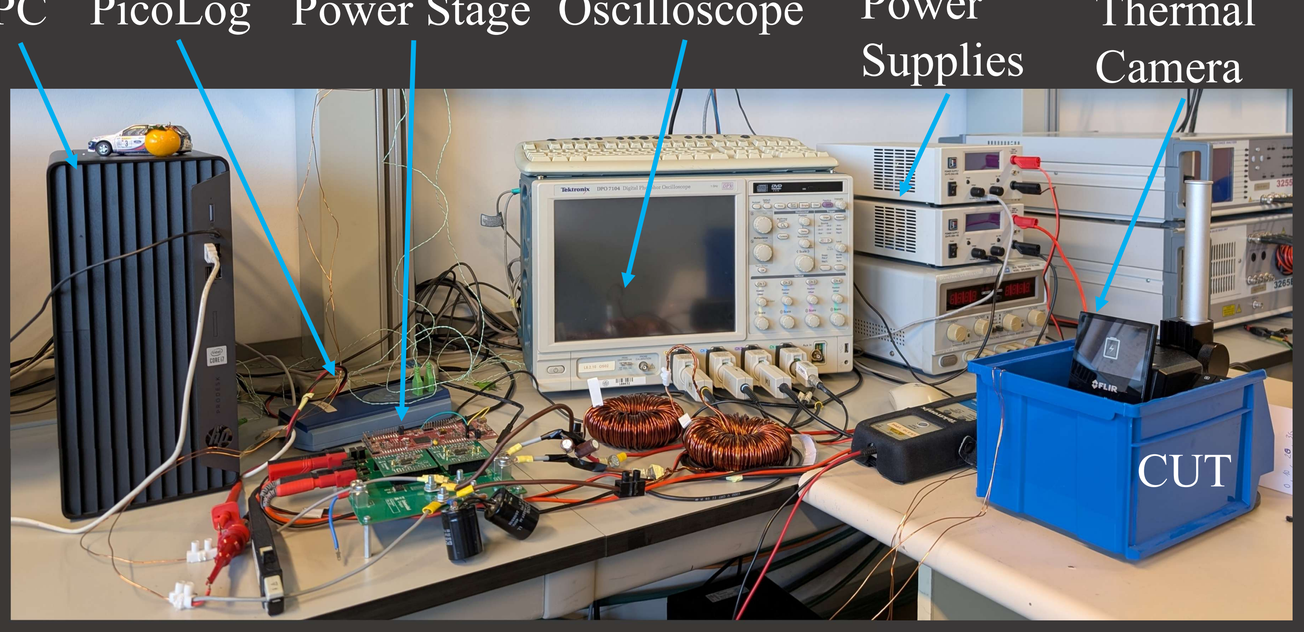
1. Introduction

Magnetic components are essential elements in power electronics designs. They are commonly used for galvanic insulation, regulation tasks, resonant converters, etc. Making the proper design of these devices is necessary to achieve optimal performance and efficiency. However, designing a magnetic component is a complex task due to insufficient data provided by manufacturers.

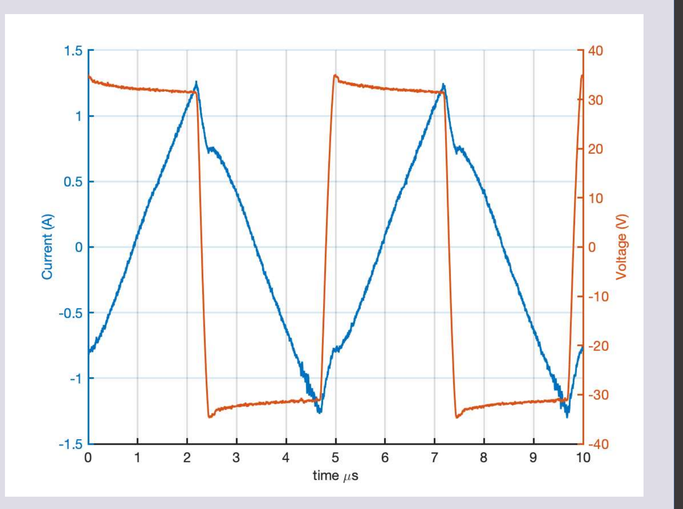
Typically, much attention has been given to core excitation waveforms, thermal conditions or material selection, but the influence of core geometry and size is often underestimated. This paper gives a reference to designers on how these parameters affect the behaviour of core losses by testing multiple sizes and geometries of the same material in different operation points.

2. Measurement Setup

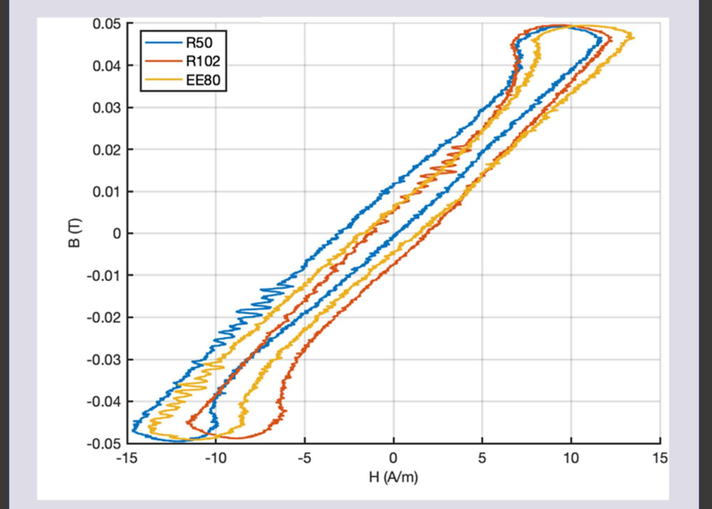


Cores under test (CUT)

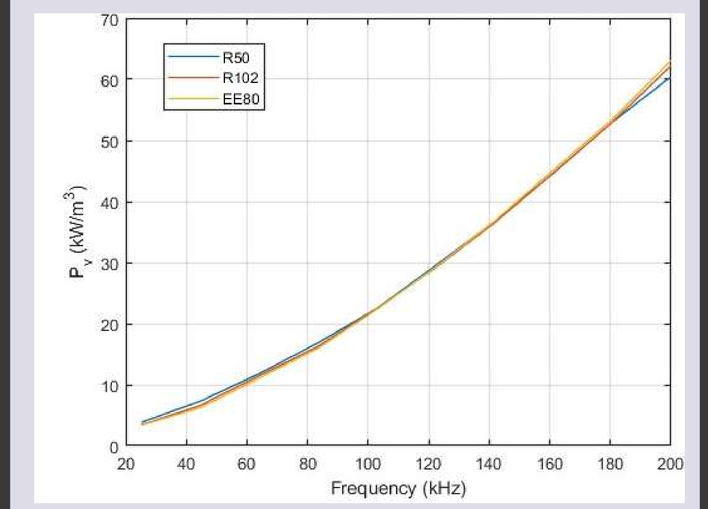
3. Experimental Results



Voltage and current waveforms form the oscilloscope



B-H loops for three different cores for a máximum flux density of 50 mT at 200 kHz and 25 ºC



Losses per volumen as a functoin of frequency for a máximum magnetic flux density of 50 mT at 200 kHz and 25 ºC

4. Conclusions

This work has experimentally proven that both the size and geometry of magnetic cores can influence core losses, even when the core material and winding configurations remain unchanged. Through controlled excitation of different core types, it was observed that changes in physical dimensions lead to measurable differences in energy dissipation.

While the volumetric losses (kW/m³) showed relatively modest variation, the absolute losses (W) highlighted more pronounced disparities, especially relevant for compact magnetic components commonly used in high-frequency power electronics.

5. References

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