

Modeling Magnetic Core Loss for Sinusoidal Waveforms

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Among the challenging unsolved technical problems that have plagued the minds of scientist and engineers throughout the 20th and 21st century is the development of a quantifiable model to accurately estimate or explain Core Power Losses (CPL). CPL is the input power that is consumed by the magnetic material used in a magnetic circuit. These losses reduce the end users usable power and must be accounted for in system design. To compensate for these losses, large safety factors must be incorporated which result in over-designed systems (motors, generators). If the losses can be accurately modeled, these safety factors could be reduced. As the safety factor decreases, so does the size, weight, and cost of the system.

The outcome of an open-literature review of CPL found that there are many CPL estimation equations, but very little work has been reported that compared these models to actual Power Ferrite data. So, this thesis described and then compared several current CPL models using experimental collected data and then validated the use of several of the terms used in these models. Specifically, the accuracy of the low frequency use of the Hysteresis Loss Equation was investigated and the validity of the use of two independent variables, core area and conductivity, commonly found in many CPL empirical equations, was analyzed.