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# Tue-Af-Po2.19-06 [47]: Calculation of Iron Losses for Soft Magnetic Materials Under Sinusoidal Pulse Width Modulation (SPWM)

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Copper losses and iron losses are the two most significant losses in electrical machines. The iron loss is a large portion of the total losses, and it mainly influences efficiency. The copper losses are relatively easy to calculate and it will be negligible if current is too small; on the other hand, the calculation methods of iron losses are more complicated than the copper loss calculation. If no measurement data are provided for materials, approximation-based methods have to be used. The famous empirical equation is Steinmetz equation, but it only works for the sinusoidal and limits frequency range. According to research data, improved generalized Steinmetz equation (IGSE) give highly accurate results among the Steinmetz-based methods for non-sinusoidal. Outside the Steinmetz-based methods, loss surface approach also provides good results which can be used for materials if no data sheet is available and change the material's characteristics due to the cutting process. Nowadays a widely used of power electronics devices and most of the electric machines are fed with voltage source inverters (VSI) with SPWM schemes, which can cause extra core losses due to the presence of harmonic components. In this research, we use the different modulation ratio and carrier ratio of SPWM as excitation waveform to excite the ring simples of soft magnetic composite (SMC) and silicon steel materials. We also take fast Fourier transform (FFT) as a tool to analyze total harmonic distortion (THD) of different SPWM. Even, the calculation results of IGSE, loss surface approach and how THD influence on the iron loss calculation are compared and analyzed under the different ratio of SPWM. Due to the results, the modulation ratio has a more significant effect on iron losses than the carrier ratio and THD also play essential roles according to the iron losses analysis.

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