INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Analysis and Evaluation of Electromagnetic Losses in Induction Machines and their Impact on Motor Design and Performance

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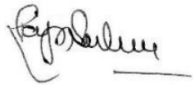
SHORT ABSTRACT

In this thesis, various electromagnetic losses, viz. core losses and stray losses of an induction machine have been studied and characterized for their fast and accurate representation in the iterative motor design process. To accomplish this, the first part of the work uses the measurement results of various medium power three-phase induction motors ranging from 1kW to 375kW output power. The factors affecting the stray losses and the magnetic circuit parameters of a motor are then investigated for all these motors to develop various empirical correlations of stray loss.

The operating slip of the motor represents its loading quotient and, the ratio of fundamental to the carrier governs the time-harmonics in the load current. Loading of the motor and harmonics present in the power supply source are also affect the loss distribution. The work attempts to formulate this by testing the induction motors at combinations of different shaft-torques and fundamental to carrier frequency ratios. Along with this, the impact of slot geometry on these magnetic losses, in support of the proposed model's capability, is demonstrated by designing the motors of the same efficiency class but different fractions of stray losses.

The comparison of various existing state-of-the-art existing loss models with the proposed model reveals that, apart from exhibiting the highest closeness to the measurement results, the proposed model is usable for the already existing motor and the design phase. Moreover, the model can determine the SL in case motors have the same output power but different geometric design, which other existing models cannot. Moreover, the work presents a straightforward approach to core loss estimation in its final part, wherein a more precise and realistic evaluation of eddy current loss is proposed. This approach considers the variation in lamination thickness and the impact of phase angles of induction's harmonics to figure out the area of the hysteresis loop. The approach makes the core loss evaluation very fast by making the experimental requirements minimum.



(Rajendra Kumar)