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Wed-Mo-Po3.05-05 [32]: Experimental Verification and No-load Characteristics Analysis of Permanent magnet Linear Oscillating Actuator by using Semi-3D Analysis Technique with Corrected Stacking Factor

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Recently, with the emergence of several global industries, linear oscillating actuators (LOAs) have been developed for various applications where short-stroke linear motion is required. In common LOAs, since electromagnetic losses are the parameters that determine the operating conditions and efficiency of most electrical machines, it is very important to accurately predict and reduce these losses. To reduce the loss of a single - phase LOA model with ring - type stator structure used in this paper, lamination of the radial direction perpendicular to the current direction of the coil is applied.

In contrast to normal electrical machines, radially laminated cores consist of 12-lamination blocks because of manufacturing limitations for the stator. The 12 stacked blocks are independent, and three-dimensional(3D) analysis is essential for a more accurate analysis of radially stacked LOA. However, 3D analysis takes a considerable amount of time. In this paper, we propose an analytical method that addresses the stacking factor through a two-dimensional (2D) analysis, with the aim of deriving an analytical result similar to the 3D result but with a shorter analysis time. In the 2D analysis, the stacking factor is considered in analyzing the magnetic flux density according to frequency. When the stacking factor is considered, the accuracy of the analysis is increased compared to that of the conventional 2D analysis because the area of the iron core relative to the induced magnetic flux density is taken into account. Subsequently, no-load characteristics were analyzed based on the more accurate magnetic flux density.

Finally, we compare the core loss through the proposed analysis method and the core loss through the 3D model analysis. In addition, the validity of the analytical method presented in this paper was verified by comparing the experiment of LOA actually made. Further discussion and analysis are also provided in the final paper.

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