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Tue-Mo-Po2.11-03 [90]: Dynamic Characteristics Analysis Considering Instantaneous Inductance According to Mover Position of Flat-type Permanent Magnet Linear Oscillating Machines

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Linear oscillating machines (LOMs) can control linear reciprocating motions through stroke cycles at specific frequencies. A single-phase, short stroke LOM has been developed for use in refrigeration compressors and other similar devices, because of their high transmission efficiency and simple structure. Generally, conventional LOMs are designed as cylindrical structures. However, such structures are difficult to manufacture because the stator core must be stacked in a radial direction. To overcome these disadvantages, a flat-type LOM has been proposed; they are easy to fabricate and their output power increases with the stacking length.

In this paper, an electromagnetic design and a dynamic characteristics analysis of the flat-type LOM are presented. First, the operation principle of the flat-type LOM is explained, and then, the optimum shape of a permanent magnet and stator is designed. The electro-magnetic characteristics, such as flux density, magnetic force, and back EMF, were verified through a no-load analysis. Meanwhile, the inductance and magnetic force change instantaneously depending on the position of the movable permanent magnet. For an accurate dynamic characteristics analysis of the LOM, instantaneous changes in force and inductance should be considered along with the mechanical components, such as spring, damping, and load force to analyze the characteristics of a linear operations. The characteristics of stroke and magnetic force according to the applied voltage and frequency are verified, and the efficiency of the flat LOM is confirmed in the operating range. Finally, the reliability of the analysis is verified through the manufacturing process and experiments.

More detailed discussions, analysis results, and experimental results will be presented in the final paper.

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