A STUDY OF THE PARAMETER COMPUTATIONS FOR PM-EXCITED TRANSVERSE FLUX LINEAR MOTOR

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The design and analysis of electrical machines often require analytical models for performance assessment and system simulation. Inductance, Resistance and back-EMF are important parameters of these models, and comparatively the inductance computation is so complicated in nonlinear system with Permanent Magnet (PM) that there are several papers about inductance calculation.

The various calculation methods of inductance are introduced in [1] considering each motor characteristic. According to the paper, when the saturation effect in magnetic materials is considered, coil inductances are somewhat accurately calculated by magnetic energy or flux linkage accomplished by Finite Element Method (FEM), however Transverse Flux Motors are not considered as analysis models.

Energy or current perturbation, introduced in [2], is the typical example of inductance calculation for general electric machines. Although detailed inductances of even multi-phase coils can be calculated by the perturbation method, a lot of effort and time is needed to analyze for current change.

Therefore, this paper deals with more simple and effective parameter computations for PM-excited Transverse Flux Linear Motor (TFLM) including apparent inductance and incremental inductance. Since the motor has peculiar coil shape and the magnetic materials are partially saturated, the analytical model is divided into three parts considering the method of inductance calculation, and then each method is introduced in detail. The computation is accomplished by nonlinear 3D Equivalent Magnetic Circuit Network for nonlinearity of magnetic materials. The inductances are compared with test values, and the method would be verified by the results.

Figure 1 is the schematic of the TFLM geometry and partition of coil. Each length of fabricated motor and analytical model is compared in Table I. For each part of coil as shown in Fig. 1, different analytical models are needed. The linkage and leakage flux, accomplished by analyzing each model, is used to calculate inductances. Apparent and incremental inductances for current change are achieved by the proposed methods, which would be introduced in a full paper.

In the full paper, the simple and effective method to calculate inductances of TFLM would be introduced in detail and the parameters, Inductance, Resistance and back-EMF, of TFLM are also computed. The accuracy of the proposed method is verified by the comparison of calculated inductances and test value. The calculated parameters would be useful as reliable parameter for dynamic simulation.

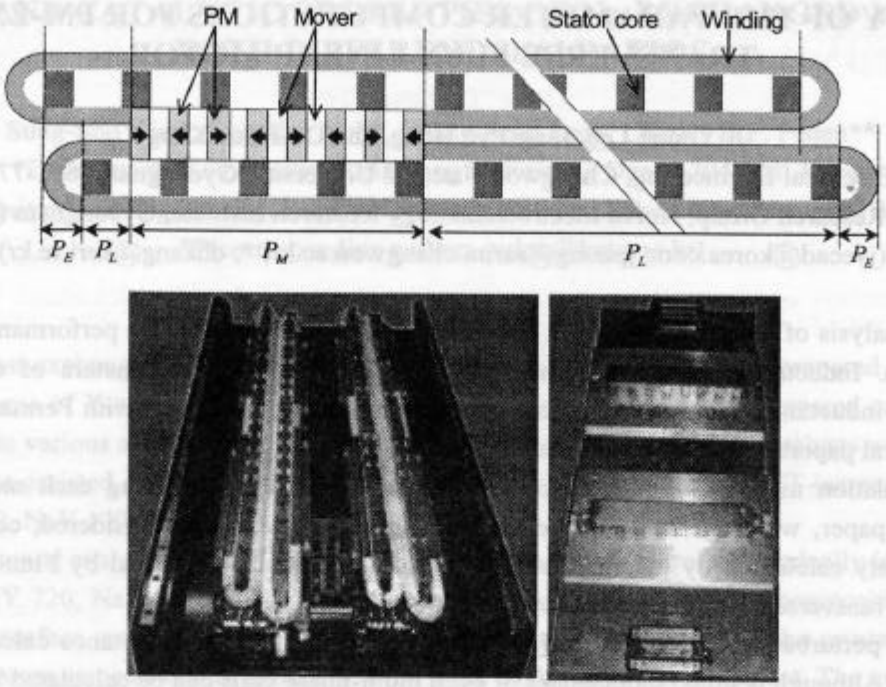

Fig. 1. (up) Schematic of the TFLM geometry and partition of coil (down) Stator and mover of TFLM

Table I

The Ratio of Lengths between analytical and fabricated models

	The length of analytical model	The length of fabricated model	Ratio
P_M	40 mm	150 mm	3.5
P_L	40 mm	714mm	18

Keywords: Inductance, Magnetic material, Nonlinearity, Transverse flux linear motor

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