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Oral Section 1 (**O1**)	**Chairmen**
Linear Machines & Applications	Prof. Xiang Cui, China
October 23, 09:50-12:00, Magnolia Hall	Prof. Ju Lee, Korea

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Analysis of a Slotless Type Permanent Magnet Linear Synchronous Motor using 3-D Space Harmonic Method
Jae-Yun Moon, Chun-Gil Jung and Gyu-Tak Kim
Changwon National University, Changwon, Korea

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The Suppression of Velocity Pulsation of the Discontinuous Primary Linear Synchronous Motor without Position Feedback
Yongjae KIM, Masaya WATADA, Susumu TORII and Daiki EBIHARA
Musashi Institute of Technology, Tokyo, Japan

O1-3 (10:30) p : 3
Size Optimization of Steel-Cored PMLSM Aimed for Rapid and Smooth Driving by using Auto-Tuning Niching Genetic Algorithm
Sang-Yong Jung and Hyun-Kyo Jung
Hyundai Motor Company, Korea

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Calculation of Inductances in Permanent Magnet Type Transverse Flux Linear Motor
J.Y. LEE, J.P. HONG, S.J. JUNG and D.H. KANG
Changwon National University, Changwon, Korea

O1-5 (11:10) p : 5
A Novel Control System Based on DSP for In-wheel Motors Driven EVs
GE Yinghui, LI Chunsheng, NI Guangzheng, Yang Shiyou, Xiong Suming
Zhejiang University, Hangzhou, China

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Yan HU Changzhi SUN, Zhifei CHEN, Renyuan TANG
Shenyang University, Shenyang, China

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Numerical Techniques I and Material Modeling	Prof. Weili Yan, China
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Gao Youhua, Wang Erzhi, and Li Yanbin
Shenyang University, Shenyang, China

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H. Hashizume, M.Satake, and K. Yuki
Tohoku University, Sendia, Japan

O2-3 (10:30) p : 9
A New Solution Procedure for Solving 3-D Eddy Current Problems with Rotationally Symmetric Geometry
Xiangyong CHEN, Yongjie ZHANG, Peihong NI, and Shiyou YANG
Zhejiang University, Hangzhou, China

Calculation of Inductances in Permanent Magnet Type Transverse Flux Linear Motor

J.Y. LEE, J. P. HONG, *Senior Member, IEEE,* S. J. JUNG, and D. H. KANG

Abstract-- **The design and analysis of electrical machines often require analytical models for performance assessment and system simulation. Inductances are important parameters of these models. In this paper, the methods of calculating apparent and incremental inductances are introduced for a transverse flux linear motor, which has a peculiar coil shape. The computation is accomplished by nonlinear three dimensional finite element method (FEM). The improved method has been verified by a test result.**

Index Terms—**Inductance, Transverse flux linear motor.**

I. Introduction

THE design and analysis of electrical machines often require analytical models for performance assessment and system simulation. Inductances are important parameters of these models, and the various calculation methods of them are introduced in [1] considering each motor characteristic. When 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). Energy or current perturbation, introduced in [2], is the typical example. 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 according to current change.

Therefore, this paper deals with simple and effective method for a magnet type Transverse Flux Linear Motor (TFLM) to calculate apparent inductance and incremental inductance. Firstly the analytical model is divided into three parts considering method of inductance calculation, and then each method is introduced in detail. The inductances of the TFLM are calculated by the method using the parameters accomplished by 3D FEM. The inductances are compared with a test value, and the method would be verified by the result.

II. Inductance Calculation 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. The calculated inductances when coil current is zero are compared with test value in Fig. 2.

III. Conclusion

In the full paper, the simple and effective method to calculate inductances of TFLM would be introduced in detail. The accuracy of the method is verified by the comparison of calculated inductances and test value. The calculated incremental inductances would be useful as reliable parameter for dynamic simulation.

References

[1] liuchen Chang, "An Improved FE Inductance Calculation for Electrical Machines," IEEE Trans. Magnetics, vol.32, No.4, pp. 3237-3245, 1996

[2] T. W. Nehl, F. A. Fouad, and N. A. Demerdash, "Determination of saturated values of rotating machinery incremental and apparent inductances by an energy perturbation method," IEEE Trans., Power Apparatus Syst., vol. PAS-101, pp. 4441-4451, 1982

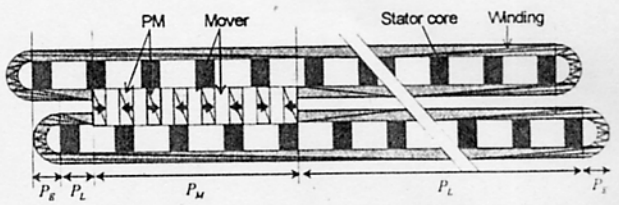

Fig. 1. Schematic of the TFLM geometry and partition of coil

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

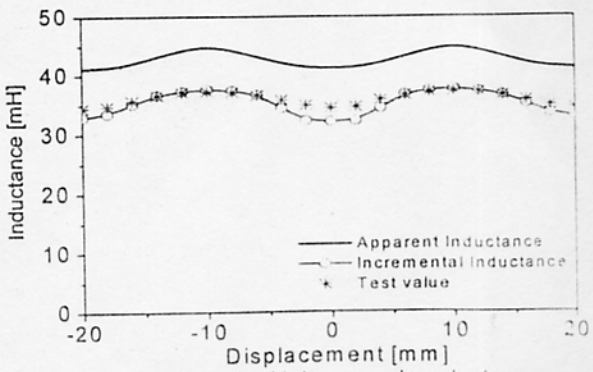

Fig. 2. The comparison of calculated inductance and tested inductance