# Dynamic Analysis of a Moving Coil Type LOA for Load Conditions using FEM Batch Process

*Duk-Hyun Kim, Jung-Pyo Hong* and *Gyu-Tak Kim*
Department of Electrical Engineering, Andong Institute of Information Technical College
#1217 Shin-duk, Andong-city, Kyungbuk, Korea
E-mail : dh0710@www.ait.ac.kr

*Abstract* – **This paper deals with the dynamic analysis of moving coil type LOA for load conditions. To more accurate analysis for the reaction of magnetomotive force by coil current, FEM batch process with moving model node technique is applied as an analysis method.**

## INTRODUCTION

Moving coil type linear oscillatory actuator(MC-LOA) with permanent magnet has a very simple structure. It has a more merits than other type like the linearity of force, a fast control response speed, making convenience and mechanical strength. But, it also has an asymmetric magnetic circuit. One side is open structure and the other is close[1]. In this type, there is a different flux density on the air-gap for moving direction. Generally, interaction between asymmetric structure and coil magnetomotive force cause the unbalanced force. It reflects the different influence on the proper function of MC-LOA by load conditions.

In this paper, two load conditions are selected for dynamic analysis. One is constant load($F_{L1}$) according to moving displacement and the other is variable load($F_{L2}$) like an air compressor[2]. They are shown in Fig. 1.

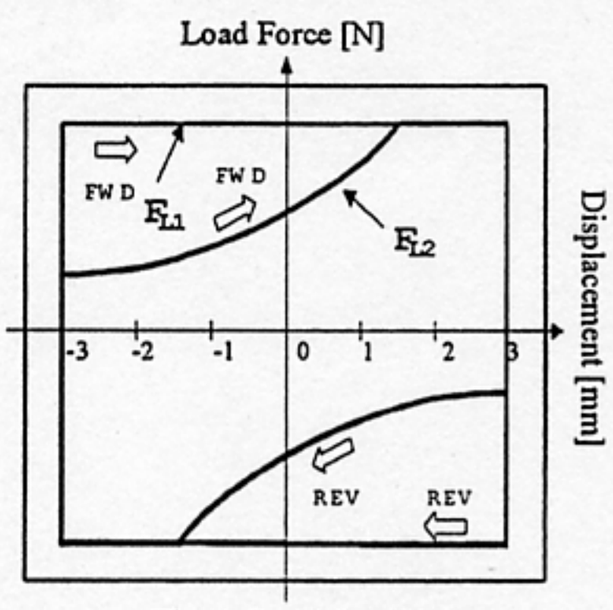



Fig. 1. Load conditions

## DYNAMIC ANALYSIS

In this paper, analysis model has an asymmetric structure and Direchlet boundary condition. Therefore, it applies moving model node technique to analysis in order to consider the variation of parameters for each moving displacement continuously.

Dynamic analysis is performed by batch process with moving model node technique, voltage equation and kinetic

Batch process for dynamic analysis is shown in Fig. 2[3].

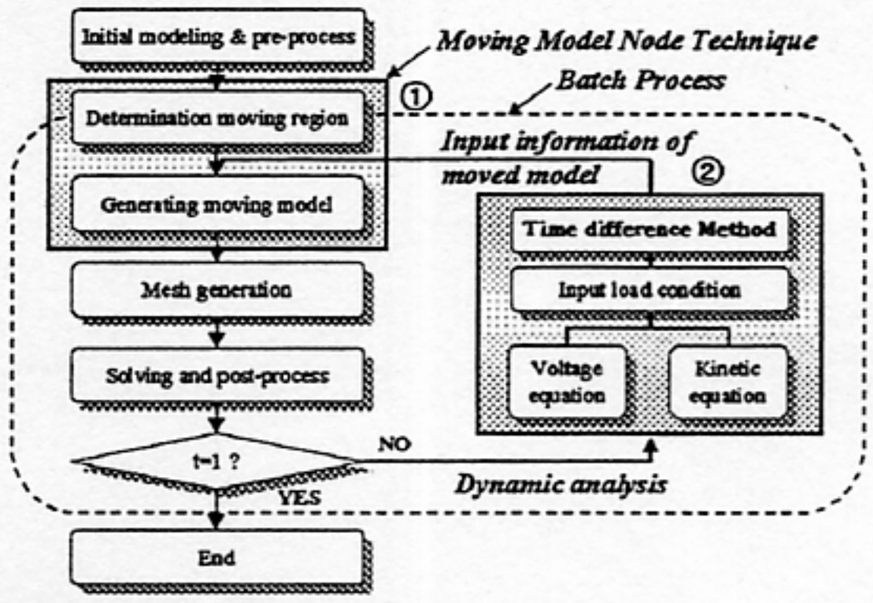
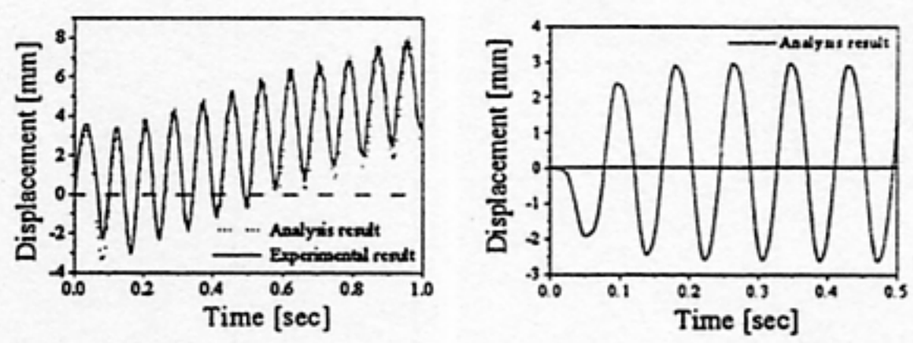



Fig. 2. Batch process for dynamic analysis




(a) constant load($F_{L1}$) (b) variable load($F_{L2}$)

Fig. 3. The result of dynamic analysis for load conditions

## CONCLUSION

The operating characteristic of MC-LOA for load conditions is shown in Fig. 3. In case of constant load, moving displacement has an eccentric effect because of the influence of asymmetric structure and coil magnetomotive force. The other case has a proper oscillation. But, the magnitude of force and displacement for moving direction is different in both cases. Therefore, we can get the more accurate results like a force difference by dynamic analysis in Fig. 2. And then, it applies this result to adequate application of MC-LOA satisfying the demanded specification of system.

## REFERENCES

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