DQ15

Analysis of Rotor Eccentricity in Switched Reluctance Motor with Parallel Winding Using FEM

Jian Li and Yunhyun Cho*

Electrical Engineering, Dong-A University, Busan, South Korea

*Corresponding author: Yunhyun Cho, e-mail: yhcho@dau.ac.kr

The air gap of SR motors in fractional horsepower applications is sensitive to rotor eccentricity [1]. The influence of winding method counteracting unbalance forces on the rotor vibration behavior is investigated in this paper. Dynamic FEM simulation is utilized to study the current distribution in the paralleled paths under rotor eccentricity. As shown in Fig. 1(a), the coil of opposite stator poles is paralleled. The inductances of paralleled paths are different due to the non-uniform air gap. The normal force on the stator poles are unequal and have the tendency to draft rotor back to its center. The connection of coil in dynamic FEM simulation is shown in Fig. 1(b) and the inductances presented in (c) shows different methods of parallel winding. The UMF acting on the rotor and shaft is obtained as shown in Fig. 2.

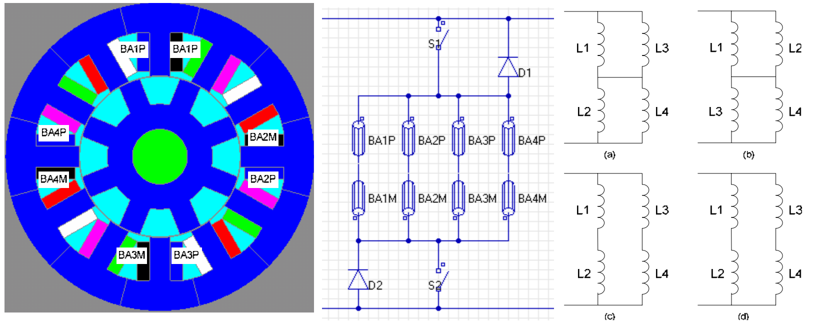

Fig. 1. (a) Displacement of coil in a 12/8 SRM; (b) Circuit of dynamic FEM simulation; (c) Different parallel winding method.

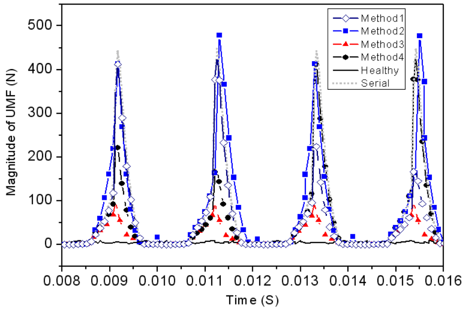

Fig. 2. Magnitude of UMF acting on the shaft.

REFERENCES

[1] Sheth, N.K.; Rajagopal, K.R, Magnetics, IEEE Transactions on Volume 40, July 2004 Page(s):2032 - 2034.

DQ16

Lorentz-Force Propulsion Mechanism for Moving a Long and Continuous Steel Beam

Jung Soo Choi[1] and Yoon Su Baek[2]*

[1]Department of Mechanical Engineering, Graduate School, Yonsei University, Seoul 120-749, Korea
[2]School of Mechanical Engineering, Yonsei University, Seoul 120-749, Korea

*Corresponding author: J. S. Choi, e-mail: jschoi@yonsei.ac.kr, Y. S. Baek, e-mail: ysbaek@yonsei.ac.kr

Magnetically-levitated feromagnetic materials need a novel noncontact propulsion mechanism with a constant vertical force to move stably forward or backward. Magnetic-levitation conveyance has been tried in a painting or coating process of the steel industry. It has a noncontact nature and makes ferromagnetic products high-quality without any scratches or dents caused by contact propulsion mechanisms. To maintain its noncontact nature, a propulsion mechanism should affect a magnetic levitation mechanism very little. However, linear induction motors [1, 2] for propulsion inherently generate time-varying vertical forces to a ferromagnetic object. As these forces vibrate the object, they deteriorate the stability and performance of a magnetic levitation system.

The purpose of the work is to generate a constant vertical force for suspension and a constant horizontal force for propulsion to a long and continuous ferromagnetic material. To do this, we propose a novel propulsion mechanism with a modified Lorentz-force principle which can move a steel beam longitudinally as in Fig. 1. An advantage of the mechanism is to ensure the stability and performance of a magnetic-levitation conveyance system because its vertical force is time-invariant and does not vibrate the steel beam. Fig. 1 presents a propulsion system with the proposed mechanism and its operating principle. Fig. 2 shows current-force characteristics and time responses of the system.

This paper proposed a novel ferromagnetic propulsion mechanism. To confirm its feasibility, we presented time-invariant force data and also successfully implemented bidirectional propulsion experiments. The proposed mechanism is applicable to noncontact steel-plate conveyance systems.

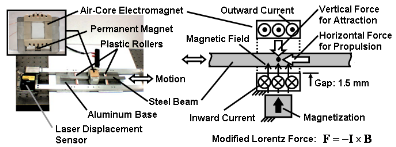

Fig. 1. Steel-beam propulsion system using the proposed mechanism and its operating principle.

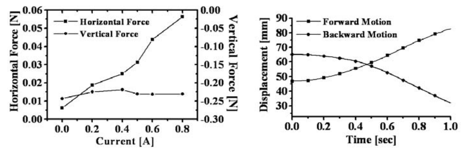

Fig. 2. Experimental results: current-force relation and bidirectional motion (step input, 0.5 A).

This work was supported by the Korea Science and Engineering Foundation (KOSEF) grant funded by the Korea government (MEST) (No. R01-2008-000-12264-0).

REFERENCES

[1] M. Morishita, US Patent Number 5,647,477, 1997.
[2] H. Hayashiya *et al*., IEEE Trans. Magn. vol. 35, no. 5, 4019-4021, 1999.