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Voltage Characteristics of a Consequent-pole Bearingless PM Motor with Concentrated Windings

Junichi Asama[1]*, Miya Amada[1], Akira Chiba[1], Masatsugu Takemoto[2], Tadashi Fukao, and M. A. Rahman[3]

[1]Tokyo University of Science, 2641 Yamazaki, Noda, Noda, Japan
[2]Hokkaido University, Kita14, Nishi 9, Kita-ku, Sapporo, Japan
[3]Memorial University of Newfoundland, A1B 3X5, St. John's, Newfoundland, Canada

*Corresponding author: Junichi Asama, e-mail: asama@rs.noda.tus.ac.jp

A bearingless motor is a single electric device combining a magnetic bearing and motoring functionality, and thus can suspend a rotating shaft without mechanical contact [1]. Compared to conventional ball bearings, the magnetic non-contact suspension generates no wear particles and low frictional heat. A consequent-pole bearingless PM motor can provide not only high torque but also sufficient radial force for stable magnetic suspension [2]. A conventional consequent-pole bearingless PM motor has distributed windings, which lead to be longer in the thrust length because of the end windings located outside the stator core. The authors have developed a new non-contact drive system employing a consequent-pole bearingless PM motor with concentrated windings (Fig. 1). The induced emf of the prototype machine was measured. However, the emf was not sinusoidal, but distorted as shown in Fig. 2. The objective of this paper is to investigate the cause of this emf distortion experimentally and numerically. It has been shown that the emf distortion is caused by a combination of the flux distribution around the rotor and the concentrated windings.

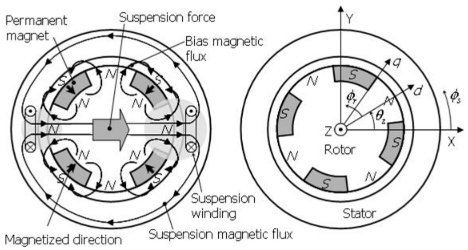

Fig. 1. Configuration of the prototype machine.

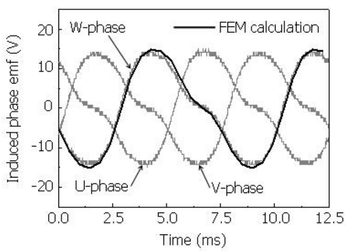

Fig. 2. Measured and simulated induced voltages.

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BQ20

Rotor Dynamics of 120,000 rpm 15 kW Ultra Speed Motor

Do-Kwan Hong*, Byung-Chul Woo, and Dae-Hyun Koo

Electric Motor Group, Korea Electrotechnology Research Institute, P.O. Box 20, Changwon, South Korea

*Corresponding author: Author1 Hong, e-mail: dkhong@keri.re.kr

In this paper, the critical speed variation of the rotor depends on fitting interference between sleeve and PM which is attached two stub shafts is simulated by commercial finite element code, ANSYS. This paper deals with rotor design and rotor dynamic for manufacture of 15 kW, 120,000 rpm air blower motor for ultra speed fuel cell. Fig. 1 shows dimension and name of rotor. Fig. 2 shows campbell diagram to find critical speed. 3D rotor dynamic analyses have been conducted using full 3D models [1]. The present computational method is based on the general finite element method with rotating gyroscopic effects of the rotor system. ANSYS which includes practice practical rotor dynamics module with various types of rotor analysis tools and bearing elements is applied. Fig. 1 shows procedure of rotordynamics of shrink fit. For the purpose of numerical verification, comparison study for a benchmark rotor model with supports bearings is performed first [2]. We found that an air foil bearing performs well, as a supported bearing for the 60,000 rpm of air blower motor. Fig. 3 shows prototype of ultra speed motor

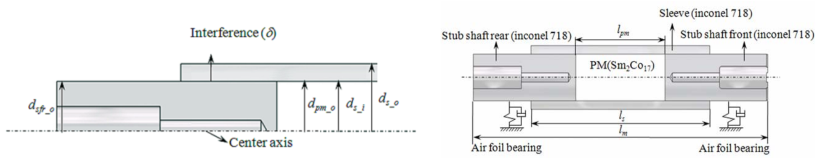

Fig. 1. Dimension and name of rotor.

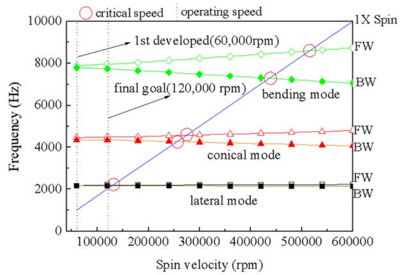

Fig. 2. Campbell diagram.

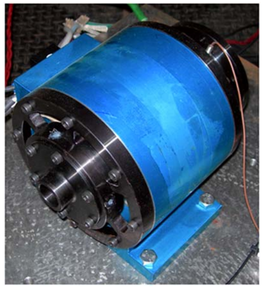

Fig. 3. Prototype of ultra speed motor.

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