

Regular Paper

Magnetic Properties Measurement Method of Magnetic Core with Inverter Excitation using Different Oscillation Scopes

Kyyoul YUN^{1,*}

¹Department of Electrical and Electronic Engineering, Gifu university, 1-1 Yanagido, Gifu, Gifu 501-1193, Japan

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Abstract

Magnetic materials instantly respond to changes in external magnetic fields by altering their internal magnetic domains. Even when subjected to alternating magnetic fields of tens of kHz or hundreds of kHz, the magnetic domains change accordingly. Recently, when using PWM inverter excitation, undesirable phenomena such as overshoot and ringing occur between the inverter and the motor. In inverters using IGBT devices, overshoot and ringing occur in the range of several hundred nanoseconds, while in inverters using SiC or GaN devices, these phenomena occur within several tens of nanoseconds. The problem is that it is extremely difficult to verify how much these phenomena affect equipment such as motors. This is because there is no established technology for accurately measuring them. When measuring magnetic properties during inverter operation, it is important to be aware that there are many sources of noise. Various countermeasures are necessary to minimize the noise as much as possible. To mitigate these noise issues, it is necessary to use isolation digitizers or differential amplifiers and differential probes, minimize the length of wiring where common-mode noise is conducted, and ensure the oscilloscope's power supply is used through an isolation transformer.

Keywords: Inverter excitation, Iron loss, Magnetic properties measurement method, Sinusoidal excitation, Inverter control parameter

1. Introduction

Currently, about half of the world's electricity consumption is attributed to motors, and with the ongoing electrification of products, the demand for motors is expected to continue rising. Although motors currently have efficiency exceeding 90%, there is still room for improvement. A mere 1% increase in motor efficiency could lead to a significant reduction in power consumption. Further enhancing motor efficiency directly contributes to substantial control of energy losses, making a positive impact on issues such as fossil fuel depletion and global warming caused by greenhouse gas emissions [1-6].

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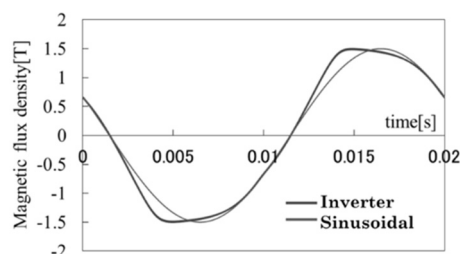


Fig. 1. Example of waveform distortion

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2. Experimental method

For sample preparation, a toroidal core was made by

*Corresponding author: Kyyoul Yun (yun.kyyoul.n0@f.gifu-u.ac.jp)