Design and implementation of an encoder calibration system for improved resolution and accuracy in IPMSM drive with embedded software

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Abstract: This paper introduces an encoder calibration system designed to enhance resolution and accuracy in interior permanent magnet synchronous motor (IPMSM) drives, complemented by customized embedded software. The system employs closed-loop control with the IPMSM drive, adjusting encoder resolution via gear ratio modifications. Communication between the human-machine interface (HMI) and the DSP's internal 28x CPU utilizes a digital RS-422 interface. The embedded software running on the 28x CPU processes real-time data and presents calibration information on the HMI. Firmware integration encompasses external analog/digital converters, comparators, digital communication interfaces, high-accuracy encoders, original encoders, and additional gear ratio adjustments. Computed compensation values are stored in EEPROM. The TMS-320F-28335 digital signal processor serves as the central control unit, facilitating encoder signal processing, embedded software execution, HMI operation, and IPMSM drive control. Experimental results confirm the feasibility of the proposed digitization approach, demonstrating its effective application in industrial control systems.

Keywords: Encoder calibration, enhanced accuracy, embedded software execution, digital signal processor, IPMSM

Biography: Ming-Yen Wei was born in Taichung City, Taiwan, Republic of China, on April 20, 1983. He received his Bachelor's and Master's degrees in Electrical Engineering from National Formosa University in 2005 and 2007, respectively, and his Ph.D. in Electrical Engineering from National Taiwan University of Science and Technology in 2012. Since late 2012, he has held industrial technical positions at a research institution for ten years. In early 2023, he joined National Formosa University as an Assistant Professor in the Department of Electrical Engineering. His research focuses on motor drive control, embedded systems, control theory applications, mechatronics, and robotics.

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