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Motion-Sensorless Control of BLDC-PM Motor With Offline FEM-Information-Assisted Position and Speed Observer

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Abstract

This paper proposes and investigates an offline finite-element-method (FEM)-assisted position and speed observer for brushless dc permanent-magnet (PM) (BLDC-PM) motor drive sensorless control based on the line-to-line PM flux linkage estimation. The zero crossing of the line-to-line PM flux linkage occurs right in the middle of two commutation points (CPs) and is used as a basis for the position and speed observer. The position between CPs is obtained by comparing the estimated line-to-line PM flux with the FEM-calculated line-to-line PM flux. Even if the proposed observer relies on the fundamental model of the machine, a safe starting strategy under heavy load torque, called I-f control, is used, with seamless transition to the proposed sensorless control. The I-f starting method allows low-speed sensorless control, without knowing the initial position and without machine parameter identification. Digital simulations and experimental results are shown, demonstrating the reliability of the FEM-assisted position and speed observer for BLDC-PM motor sensorless control operation.

Keywords

Author Keywords: Brushless dc (BLDC) motor; observers; sensorless control; starting method; variable-speed drives

KeyWords Plus: BRUSHLESS DC MOTORS; STARTING METHOD; BACK EMF; DRIVES

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