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Advanced Speed Regulation of BLDC Motors via Selective Harmonic Elimination-Based Inverter

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Abstract: *The increasing demand for efficient and precise motor control in electric vehicles and industrial applications has driven advancements in Brushless DC (BLDC) motor technology. This study proposes an advanced speed regulation strategy for BLDC motors using a Selective Harmonic Elimination (SHE)-based inverter. The primary objective is to enhance the performance of BLDC drives by minimizing lower-order harmonics in the output voltage, thereby improving torque smoothness and system efficiency. The SHE technique is employed to control the inverter's switching angles, effectively eliminating specific harmonics while maintaining the desired fundamental voltage. A detailed design of the control system, along with a simulation model, is developed to validate the effectiveness of the proposed approach. Results demonstrate significant improvements in speed stability, reduced total harmonic distortion (THD), and enhanced dynamic response. This method offers a reliable and energy-efficient solution for modern motor drive systems, particularly where high performance and reduced electromagnetic interference are critical.*

Keywords: Brushless DC (BLDC) motor, harmonic-reducing inverter, predictive speed control, pulse width modulation (PWM), selective harmonic elimination (SHE), buck converter, lithium-ion battery, battery management system (BMS), electric three-wheeler

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