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(57) Abstract :
Electric vehicles (EVs) have gained significant attention due to their potential to reduce greenhouse gas emissions and promote sustainable transportation. However, the performance and efficiency of EVs remain heavily reliant on the effectiveness of their motor controllers. Current motor control systems often face challenges such as high energy losses, inefficient power conversion, and excessive heat dissipation. This project aims to develop a high-efficiency motor controller to address these issues, optimizing energy usage, enhancing performance, and ensuring reliability in electric vehicles. The proposed motor controller integrates advanced control algorithms like Field-Oriented Control (FOC) and Direct Torque Control (DTC), which improve the response time, torque control, and overall efficiency of the motor. These algorithms allow for better dynamic performance and precise control over motor functions. To reduce switching losses and improve thermal efficiency, the design incorporates SiC/GaN-based power electronics, known for their ability to handle high power densities and minimize heat production. The controller also includes an adaptive control mechanism that adjusts in real-time based on load conditions, ensuring optimal energy distribution throughout the vehicle's operation.

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