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Permanent Magnet Motors and Switched Reluctance Motors Capabilities for EVs and HEVs: A Comparative Analysis

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Abstract: This paper presents a comparative analysis of the capabilities of permanent magnet motors and switched reluctance motors (SRM) for use in electric vehicles (EVs) and hybrid electric vehicles (HEVs). With the increasing pollution caused by conventional vehicles, electric motors are becoming increasingly popular as a means of reducing environmental impact. High power density magnetic motors such as brushless DC (BLDC) motors and permanent magnet synchronous motors (PMSM) have been the preferred choice for EVs and HEVs. However, they face challenges such as demagnetization, high cost, and fault tolerance. As a result, SRMs are expected to replace permanent magnet motors in the future for EVs and HEVs, as they have no permanent magnets on the rotor, offer a higher torque-to-power ratio, lower losses, and lower acoustic noise compared to BLDC motors and PMSMs. This paper analyzes the performance characteristics, power density control, torque ripple control, vibration control, noise, and efficiency of these special electric motors. It also offers a review of the unique aspects of BLDC motors, PMSMs, and SRM-based drive systems for EVs and HEVs, while explaining why permanent magnet motors are being replaced with SRMs for use in EVs and HEVs.

Keywords: Brushless DC (BLDC) Motors, Electric Vehicles (EVs), Hybrid Electric Vehicles (HEVs), Power Electronics Converters (PEC), Permanent Magnet Synchronous Motors (PMSM), Switched Reluctance Motors (SRM) and Special Electric Motors (SEM).

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