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Performance analysis of FOC space vector modulation DCMLI driven PMSM drive

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ABSTRACT

The effectiveness of a permanent magnet synchronous motor (PMSM) drive managed by an automatic voltage regulator (AVR) microcontroller using field oriented control (FOC) with space vector modulation (SVM) and a diode clamped multilevel inverter (DCMLI) is investigated. Due to its efficacy, FOC would be widely implemented for PMSM speed regulation. The primary drawbacks of a 3-phase classic bridge inverter appear to be reduced dv/dt stresses, lesser electromagnetic interference, and a relatively small rating, especially when compared to inverters. PMSMs have a better chance of being adopted in the automotive industry because of their compact size, high efficiency, and durability. The SVM idea states that an inverter's three driving signals are created simultaneously. Using MATLAB simulations, researchers looked into incorporating a DCMLI with a resistive load on an AVR microcontroller. Torque, current, and harmonic analysis were evaluated between the SVM and the inverter-driven PMSM drive in this research. In comparison to the prior art, the proposed PMSM drive has better speed and torque management, less output distortion, and less harmonic distortion.

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1. INTRODUCTION

The characteristics of permanent magnet synchronous motor (PMSM) are the low value of cogging torque, ruggedness, high efficiency, high power to weight ratio, and additional reluctance torque. In an electric vehicle application, the motor, run to different load and speed profiles; hence it is used application. In PMSM, due to the magnet in the rotor and constant air gap, it is not needed to supply magnetizing currents through the stator flux. When at high speed, it gives high current and fewer switching losses. If put into practice, it would allow for a range of speeds by rapidly switching between low switching frequencies for slow speeds and high switching frequencies for fast speeds [1], [2]. Vector control is the most useful method for field oriented control (FOC). The FOC approach has replaced the direct torque control (DTC) method in AC drives [3], [4] because of its superior performance. The good-current regulation, high torque response, and simple construction have the advantages of FOC. Some of the advantages of multilayer inverters include increased efficiency, lower voltage