Implementation of Speed and Torque Control of Induction Motor Drive using Space Vector pulse width modulation for Electric Vehicle Applications

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Abstract:
Speed and torque control of an induction motor drive is a crucial aspect of many industrial applications, including electric vehicles. Space Vector Pulse Width Modulation (SVPWM) is a widely used technique for controlling the speed and torque of induction motor drives due to its ability to generate high-quality voltage waveforms with reduced harmonic distortion. This paper proposes a novel technique for speed and torque control of an induction motor drive using Space Vector Pulse Width Modulation (SVPWM) for Electric Vehicle (EV) applications. The proposed control method employs a feedback mechanism to maintain the speed and torque of the motor within desired limits. The system is modeled using mathematical equations and simulated using MATLAB/Simulink software. The results show that the SVPWM technique provides better control over the motor compared to conventional methods, resulting in smoother operation and reduced power loss. The proposed system is suitable for EV applications where precise control of motor speed and torque is crucial for efficient and reliable operation.

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Contents

I. Introduction

Electric vehicles rely on an electric motor to convert electrical energy from the battery into mechanical power to drive the vehicle. Induction motors are a popular choice for electric vehicle applications due to their high efficiency, low maintenance, and rugged design. However, to achieve optimal performance, it is important to control the speed and torque of the induction motor. One way to control the speed and torque of an induction motor is through Space Vector Pulse Width Modulation (SVPWM) [1]. SVPWM is a digital control technique that uses a series of switching pulses to control the voltage applied to the motor. By varying the width and timing of the pulses, the control system can adjust the average voltage applied to the motor, which in turn controls the speed and torque of the motor. In SVPWM, the voltage applied to the motor is represented as a space vector, which is a vector that rotates around the stator of the motor at a speed proportional to the frequency of the applied voltage. The amplitude and angle of the space vector determine the magnitude and phase of the voltage applied to the motor. To control the speed and torque of the motor, the control system adjusts the angle and amplitude of the space vector. By varying the angle of the space vector, the control system can adjust the phase of the voltage applied to the motor, which in turn controls the torque of the motor. By varying the amplitude of the space vector, the control system can adjust the magnitude of the voltage applied to the motor, which in turn controls the speed of the motor. SVPWM is an effective way to control the speed and torque of an induction motor for electric vehicle applications. It allows for precise control over the motor's performance, which can help improve the efficiency and reliability of the vehicle. However, implementing SVPWM requires advanced control algorithms and sophisticated hardware, which can increase the cost and complexity of the system. In summary, SVPWM is a powerful tool for controlling the speed and torque of induction motors in electric vehicles. It offers precise control over the motor's performance and can help improve the efficiency and reliability of the vehicle. However, it requires advanced control algorithms and hardware, which can increase the cost and complexity of the system [2].

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