Chapter-10

Speed and Torque Control of Induction Motor using Space Vector Modulation

[1]J. Shiva, [2]K. Pavani, [3]J. Viswaswara rao, [4]B. Papi Naidu
[1]Faculty, [2,3,4]Student, Dadi Institute of Engineering & Technology, Anakapalle
jshiva@diet.edu.in, 20U45A0225@diet.edu.in

A control strategy based on SVM is proposed for achieving precise speed and torque control of induction motor drives. The project begins with a literature review of various speed and torque control methods for induction motors and an explanation of the principles of space vector modulation. The back ground and mathematical models are developed for the induction motor drive and the SVM-based control algorithm.

Space vector modulation (SVM) is a pulse width modulation (PWM) technique that is used to generate the required voltage waveform for the control of induction motors. SVM provides higher output voltage compared to other PWM techniques, resulting in smoother motor operation, and reduced harmonic distortion.

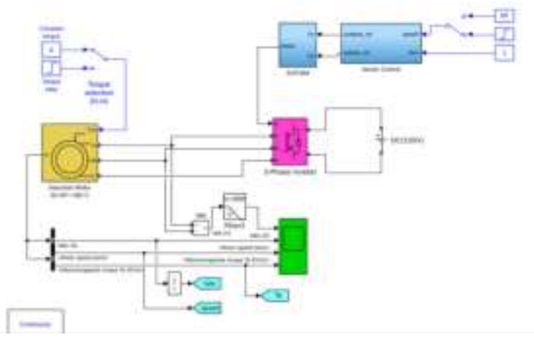

Figure 1: Simulink diagram

SVM also allows for high-resolution control of the output voltage waveform, which improves the accuracy of speed and torque control. The speed and torque control of induction motors is a critical aspect in various industrial applications such as pumps, fans, compressors, and conveyor systems. Space Vector Modulation (SVM) is a popular digital control technique that provides an efficient and accurate method for controlling the speed and torque of induction motors

The methodology for speed and torque control of induction motor drive using space vector pulse width modulation involves the following steps:

1. The first step in this project is to conduct a comprehensive literature review of the existing research on SVM-based control techniques for induction motor drives.
2. The second step is to model the induction motor drive using mathematical equations
3. The third step is to design the Space Vector Modulation (SVM)control system for the induction motor drive.
4. The SVM control algorithm will be designed based on the mathematical model of the motor drive developed in step 2. The simulation results will be used to fine-tune the control system parameter sand evaluate its performance.
5. The fourth step is to implement the designed control system on hardware. The control system will be implemented on a microcontroller board and tested on a small

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induction motor drive. The hardware implementation will provide insights into the practical challenges and limitations of the control system.

Simulink results: In this project, the speed and torque control of an induction motor drive using space vector modulation technique has been successfully implemented and tested. The simulation results have demonstrated that the proposed method can provide accurate and fast control of the speed and torque of the motor, even under varying load conditions. The use of space vector modulation technique has several advantages over other modulation techniques, such as higher efficiency, faster response time, and reduced harmonic distortion. The method has shown promising results in practical applications and has the potential to be implemented in various industrial applications

In conclusion, the proposed method for speed and torque control of an induction motor drive using space vector modulation technique is a reliable and effective control strategy. The study highlights the potential of this method in practical applications and can serve as a useful reference for researchers and engineers working in the field of electric motor drives.

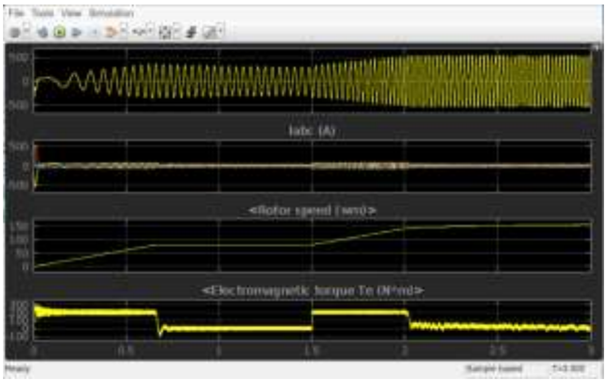

Figure 2: Simulink result.

The simulation results demonstrate that the SVM control system successfully maintains the desired motor speed and torque under different operating conditions. The control system exhibits fast transient response and dynamic performance, indicating that it is suitable for high-performance motor drive applications. The stator current waveform is sinusoidal, indicating that the SVM control system is effectively controlling the voltage and frequency supplied to the motor.

The PI controllers for speed and torque control are effective in maintaining the desired motor speed and torque. One potential area of future research is the implementation of advanced control algorithms that incorporate artificial intelligence (AI) and machine learning techniques to optimize motor control and improve energy efficiency. Another area of future research is the integration of the motor control system with a smart grid, which would allow for real-time monitoring and control of the motor's speed and torque in response to changes in the grid's demand and supply conditions.

Additionally, the project's findings could be applied to the development of more efficient and reliable electric vehicle propulsion systems, where precise control of motor speed and torque is critical for efficient and safe operation. Overall, the project has the potential to open new avenues for research and innovation in the field of motor control, with far-reaching implications for various industries and applications.

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