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# Programmable Wireless SVPWM Based Speed Control Drive for Induction Motor

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***Abstract*: These The induction motor has its place in different domestic uses in more than 85 percent of industrial motors. A constant motor with shunt characteristics significantly reduces speed by only a few percent from no charge to full load. In the past, inductive motors have therefore mainly been used in applications with constant speed. In comparison to the dc system, conventional speed control methodologies were either high cost or very unreliable. Nonetheless dc drives are not appropriate for use in unsafe and polluting surroundings because of the presence of commuter and brushes in latter which need repeated maintenance. On the other hand, they are designed for fans, blowers, crane, traction, transport systems, etc., thanks to the easy, tough, low-cost and subsequently lighter construction of induction motor drives (particularly the type of squire cage).**

***Keywords*: SVPWM, Induction motor.**

## 1. Introduction

This project presents design and implementation of hybrid-space vector pulse width modulation (SVPWM) inverter for induction motor drive. In recent years, the field-oriented control of induction motor drive is widely used in high performance drive system. It is due to its unique characteristics like high efficiency, good power factor and extremely rugged construction. This scheme is able to adjusts the speed of the motor by controlling the frequency and amplitude of the stator voltage i.e. the ratio of stator voltage and frequency should be kept constant. This project's main objective is to speed regulate the induction engine with harmonics in voltages and line current reduction. The variable voltage and frequency supply systems are used for speed control on the induction motor number of Pulse Width Module (PWM). Flux control enables both the frequency and voltage of the induction motor drive to be controlled. The induction engine drives supplied by PWM inverters are thus dependable and offer a variety of speeds. It also increases productivity and output relative to motor drives with fixed frequency induction. PWM signals, used at the gateways of the power switches at various times, regulate the energy supplied by the PWM inverter to the inductive generator. The Sine PWM (SPWM) and hybrid SVPWM are the most commonly used PWM techniques for the VSI triphase. The inverter produces optimal voltage waveform by utilizing the hybrid space vector method, minimizes harmonic contents and minimizes torque rippling. Thus, SVPWM hybrid is better than Sine-PWM.

## 2. Methodology

### A. Block Diagram

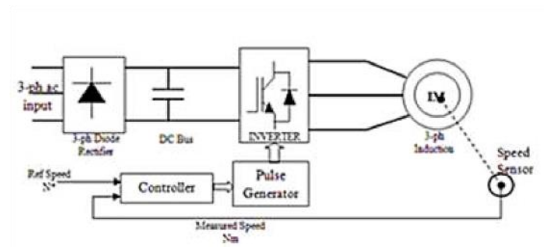


Fig. 1. Basic block diagram

For this experiment, the hybrid space vector solution is used as an optimized method of control for the induction motor power, which minimizes the rip-off power. Furthermore, we will may low to minimum torque waves by hybrid SVPWM technology.

It is a pulse width modulation (PWM) power algorithm. SVPWM is used to produce waveforms of alternate current (AC). It is also used to operate three-phase AC motors at DC voltage variable speeds. Different variants of SVPWM contribute to specific efficiency and specifications for computing. This evolution is due to the fast switching inherent in these algorithms in rising the total harmonic distortion (THD). Modulation of Space Vector is a multi-phase AC generation PWM operator algorithm. The reference signal will be often sampled after a sample, for an appropriate fraction of the sample period, for integrating the reference signal with an average of the used vectors, non-zero active switching vectors adjacent to the reference vector and one or more of the zero switching vectors will be preferred.

### B. Inverter System

The two signals are mixed into the comparator, whose output is high if the sine wave is larger than the triangle and the comparators output is low wheat, since in the same stage, the inverter PW M technology can be used for three-phase inverters where three sine waves, which shift by 120 ° and the desired output frequency are comparable to the very high frequency carrier triangle. The inverter output Voltage is not smooth, but a subtle waveform and therefore more likely than the output wave is made up of harmonics that are usually unwanted as these load performances deteriorate.

## 3. Control Techniques

### *A. Direct Torque Control*

The direct torque control or DTC, as the name indicates, is a direct control of the electric motor 's torque and flow by selecting power converter space vectors via a search table. Since no coordinate transformations, current controls and modulations are required, the key benefit of DTC being its simpler layout.

### *B. Field Oriented Control*

Field-oriented regulation or FOC procedures monitor motor drive voltage frequency, amplitude and direction. A three-phase voltage is a key to a field-oriented control system to control the three-phase stator current as a phasor which controls the rotor flow vector and finally the rotor current phasor.

The field-oriented control consists of testing the current of the stators defined by a matrix. This regulation is focused on predictions that turn a 3-phase time and speed mechanism into two invariant time structures (d and q co-ordinates).

### *C. Volts/Hertz Control*

The most common form of scalar control is the constant volt/ hertz control system, which regulates the magnitude of variables such as frequency, voltage, or current. The signal regulation and input are DC and are commensurate with the corresponding variables. The goal of the volts/hertz control system is to hold AC Induction air gap stream constant to achieve greater rpm performance.

Stator flux voltage is proportional to the voltage-frequency ratio of stators. The stator flux stays stable if the ratio is retained, and the motor torque relies on slip only Duration-Frequency.

### *D. PID Controller*

The PID is a function algorithm that seeks to balance the device features. Proportional. Within a PID control system, there are three major components to remember. Growing part is prefixed and gives you instant control benefit for driving your device if you are connected together.

It speeds the cycle up to the defined level when applied to the proportional term and also reduces the residual steady-state error that can be felt even through a proportional device. The amount of error shift is determined by calculating the disparity between the mistake and the mistake over time.

## 4. Principle of Space Vector Pulse Width Modulation

There can be eight different variations of on and off trends. The lower switches 'on and off status are the higher ones' reversed settings. The phase voltages for eight switching pattern combinations can be calculated and then transformed into two reference frames for stators. Six non-zero voltage vectors and two zero vectors result from this transformation. The non-zero vectors are the poles of a six-sector hexagon (V1-V6). There are a 60 degrees electrical angle between neighboring two non-zero vectors. The nil vectors have their origin and the engine has a nil voltage vector. The hexagonal boundary created by vectors other than nulli is where the highest power voltage is found. Total voltage in the output step and line-to - line voltage obtained by the usage of SVPWM.

Vdc is Vdc = 6 * Vph Rms for a particular r.m.s. voltage

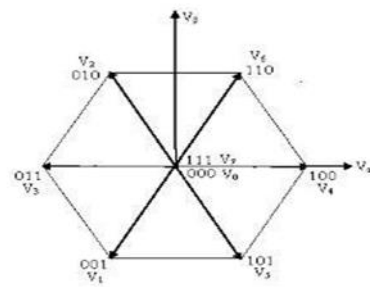


Fig. 2. Non-zero vectors forming a hexagon and zero vectors

Only two adjacent non-zero voltage Vx and Vx+60 vectors and zero vectors are practically to be used. The corresponding sector is firstly determined according to the reference voltages Vα and Vβ.

Table 1
Space Vector Switching States

| Space Vector | | Switching States | ON-state Switch | Vector Definition |
|---|---|---|---|---|
| Zero Vectors, $V_O$ | | 7(+++)<br>8(- - -) | $S_1, S_3, S_5$<br>$S_2, S_4, S_6$ | $V_O = 0$ |
| Active Vectors | $V_1$ | 1 (+--) | $S_1, S_6, S_2$ | $V_1 = (2/3)V_d\, e^{j0}$ |
| | $V_2$ | 2 (++-) | $S_1, S_3, S_2$ | $V_2 = (2/3)V_d$ e j$\pi$/3 |
| | $V_3$ | 3 (-+-) | $S_4, S_3, S_2$ | $V_3 = (2/3)V_d$ e j2$\pi$/3 |
| | $V_4$ | 4 (-++) | $S_4, S_3, S_5$ | $V_4 = (2/3)V_d$ e j3$\pi$/3 |
| | $V_5$ | 5 (--+) | $S_4, S_6, S_5$ | $V_5 = (2/3)V_d$ e j4$\pi$/3 |
| | $V_6$ | 6 (+-+) | $S_1, S_6, S_5$ | $V_6 = (2/3)V_d$ e j5$\pi$/3 |

Space Vector Modulation (SVM) is one of the common real-time Pulse Width (PWM) modulation techniques and is commonly used for voltage I (VSI) digital power. In a 2-level inverter the operational status of both switches can be represented with Switching State '+,' which means that the upper switch of the inverter leg is + Vdc, whereas the voltage of the inverter is + Vdc, and '-' refers to the terminal voltage of the inverter being zero due to the lower switch conduction. In two level inverters, eight possible switching state combinations are available. For illustration, the '1' (+ --) switching state correlates with the S1, S6 and S2 transitions in the A, B and C legs. Null states and other functioning systems include 8 flipping systems '7' (+++), '8' (---).

## 5. Conclusion

Stator stress and frequency fluctuations are conducted proportionally; hence the ratio V/F is unchanged. From the study and performance, the speed of an induction motor can be managed effectively using SVPWM. During this research simulation will be simulated and waveforms observed with the simulation of engine speed regulation via Volt/hertz method using SVPWM.

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