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RESEARCH ARTICLE

Study Locus Comparison on "PAM, and Space Vector PWM using a Simulink Model along with the Generation of PAM and PPM"

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Abstract – There are some method which on compared by ease of implementation by analyzing the harmonic spectra of various output voltage and their total harmonic distortion. SVPWM technique increases the output voltage then other techniques used. During these investigation, we analyze the obtained result and compared the output voltage value of PWM and SVPWM along with generation of PAM and PPM.
Keywords: -PAM, PPM, PWM, SVPWM, SVM, THD, FFT

I. INTRODUCTION

There are several techniques used for controlling semiconductor converter. PAM, PPM, PWM and SVPWM technique are used. PWM is an advance technique position of the pulse get controlled. The real use of PAM is in digital communication system that employ time division multiplexing. In this system more that one channel of communication can be sent through a single wire, fibre optic cable or RF frequency. Sinusoidal PWM technique is commonly used in industrial applications and is abbreviated here as SPWM. The frequency of the modulating wave determines the frequency of the output voltage. The peak amplitude of modulating wave determines the modulation index and in turn controls the rms value of output voltage. The rms value of the output voltage can be varied by changing the modulation index. This technique improves distortion factor significantly compared to other ways of multi-phase modulation. The pulse position modulation (PPM) is a modulation technique designed to achieve the goal like simple transmitter and receiver circuitry, noise performance, constant bandwidth and the power efficiency and constant transmitter power. In pulse position modulation the amplitude of the pulse is kept constant as in the case of the FM and PWM to avoid noise interference. Unlike the PWM the pulse width is kept constant to achieve the constant transmitter power. The modulation is done by varying the position of the pulse from the mean position according to the variation in amplitude of modulating signal. SVPWM is the most efficient technique using now a days. SVPWM is the most efficient technology used among all. Comparing all the four technique this one is having less harmonic distortion in a three phase voltage source rectifier. Harmonics have a negative effect on power factor also.

II. Problem in previous technique

On analyzing PWM and SVPWM we had seen that harmonic distortion is occurring more in PWM as compared to SVPWM and the output voltage of PWM is less as compared to SVPWM. To overcome of this problem we are using these technique to identify which one is better among all.

III. Basics Of PWM and SVPWM

A. BASICS OF PWM

This is the most popular method of controlling the output voltage and this method is known as pulse width modulation control.
The advantage possesed by PWM technique are as follows:

- Without any additional component the output voltage can control this method.
- Using this method, lower order harmonics can be reduced or removed with its output voltage control. As high order harmonics can be filtered easily, the filtering requirement are minimized.

A low frequency sinusodial modulating waveform is compared with a high frequency triangular waveform, which is called carrier waveform. The switching state is changed when the sine waveform intersect the triangular waveform. The crossing position determines the variable switching times between state. The switches in the voltage source inverter can be turned on and off as required. In the simplest approach, the top switch is turned on if turned on and off only once in each cycle, a square waveform results. However, if turned on several times in a cycle an improved harmonic profile may be achieved. In the most straight forward implementation, generation of the desired output voltage is achieved by comparing the desired reference waveform(modulating signal) with a high frequency triangular carrier wave as depicted schematically. Depending on whether the signal voltage is larger or smaller than the carrier waveform either the positive or negative dc bus voltage is applied at the output. Note that over the period of one triangle wave, the average voltage applied to the load is proportional to the amplitude of the signal during this period. The resulting chopped square waveform contains a replica of desired waveform in its low frequency components, with the higher frequency components being at frequency of an close to the carrier frequency. Notice that the root mean square value of the ac voltage waveform is still equal to the dc bus voltage, and hence the total harmonic distortion is not affected by the PWM process.

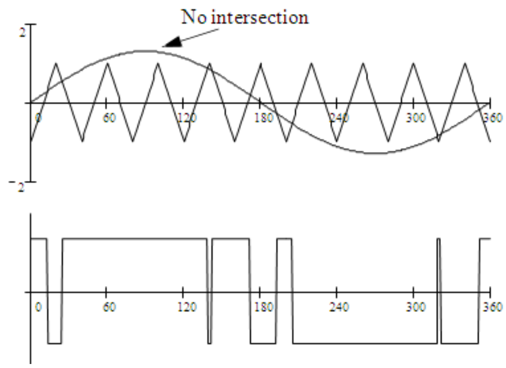

Figure.1 represents sampling of modulation wave with a triangular wave.

B. BASICS OF SVPWM

Another method for increasing the output voltage about that of the SPWM technique is the space vector PWM (SVPWM) technique. In the SVPWM technique, the duty cycles are computed rather than derived through comparison as in SPWM. The SVPWM technique can be increased the fundamental component by up to 27.39% that of SPWM. The fundamental voltage can be increased upto a square wave mode where a modulation index of unity is reached.

SVPWM is accompolished by rotating a reference vector around the state diagram, which is composed of six basic non-zero vector forming a hexagon

SVPWM is a form of PWM and is more efficient compared to natural and regularly sampled PWM. In the space vector modulation, a three phase two level inverter can be driven to eight switching states when the inverter has six active states and two zero states.

A typical two level inverter has 6 power switches that generate three phase voltage outputs. The circuit has a full bridge topology with three inverter legs, each consisting of two power switches. The circuit allows only positive power flow from the supply system to the load via a full-bridge diode rectifier. Negative power flow is not possible through the rectifier diode bridge.

The three phase inverter is therefore controlled by six switches and eight inverter configurations. The eight inverter states can be transformed into eight corresponding space vectors. In each configuration, the vector identification uses a'0' to represent the negative phase voltage and a'1' to represent the positive phase voltage level. The relationship between the space vector and the corresponding switching states. The, switches is one inverter branch are controlled in a complementary fashion. Therefore, we use orthogonal coordinates to represent the three phase two level inverter in the phase diagram

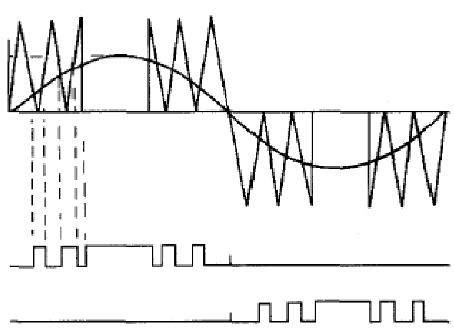

Figure.2Represent generation of SVPWM.

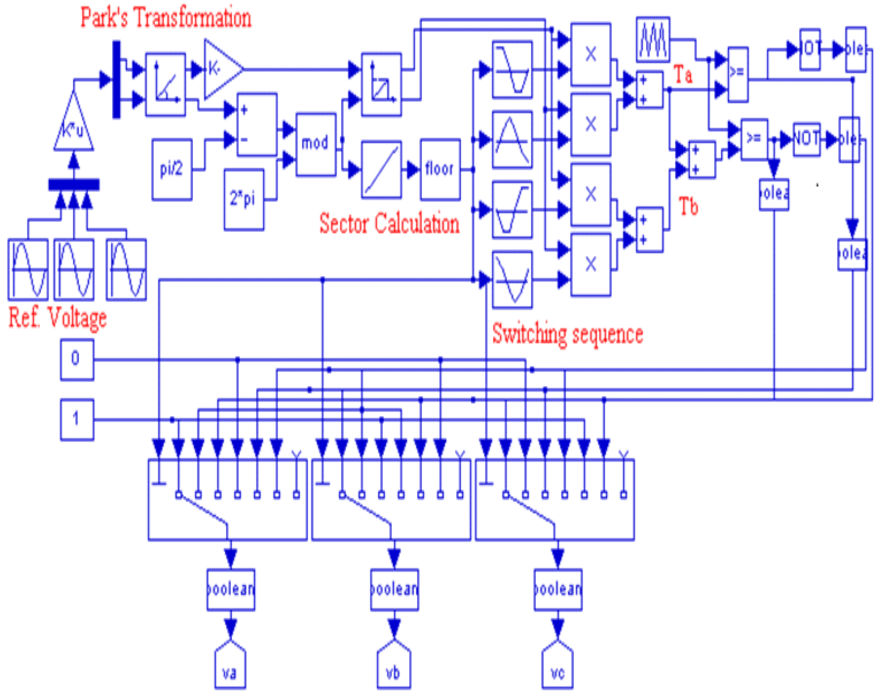

Figure.3 represents simulink model of SVPWM

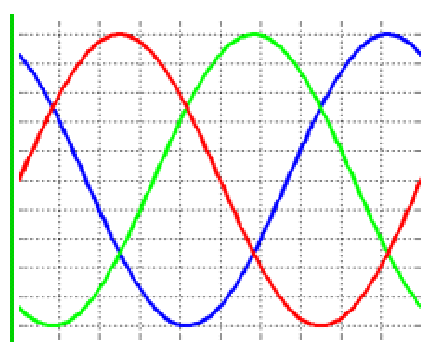

Figure.4 represents three phase sinusoidal signal applied as input to the simulink model.

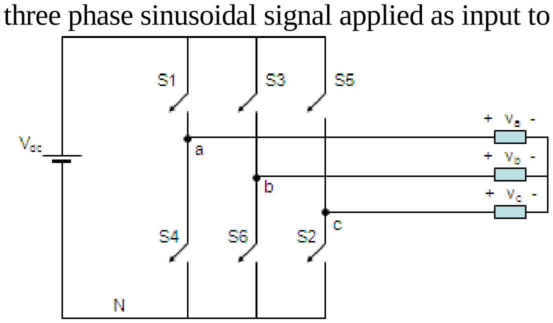

Figure.5 represents a voltage source inverter

$$\bar{v} = \frac{2}{3} V_{dc} \left(S_a + a S_b + a^2 S_c \right)$$

The locus of the reference vector is the inside of a circle with a radius of 1/2Vdc.In the SV modulation it can be shown that the length of each of the six vectors is 2/3Vdc .In steady state the reference vector magnitude might be constant. This fact makes the SV modulation reference vector locus smaller than the hexagon described above. This locus narrows itself to the circle inscribed within the hexagon, thus having a radius of $1/\sqrt{3}$ Vdc. In figure below the different reference vector loci are presented.

IV. Implementation of simulink model

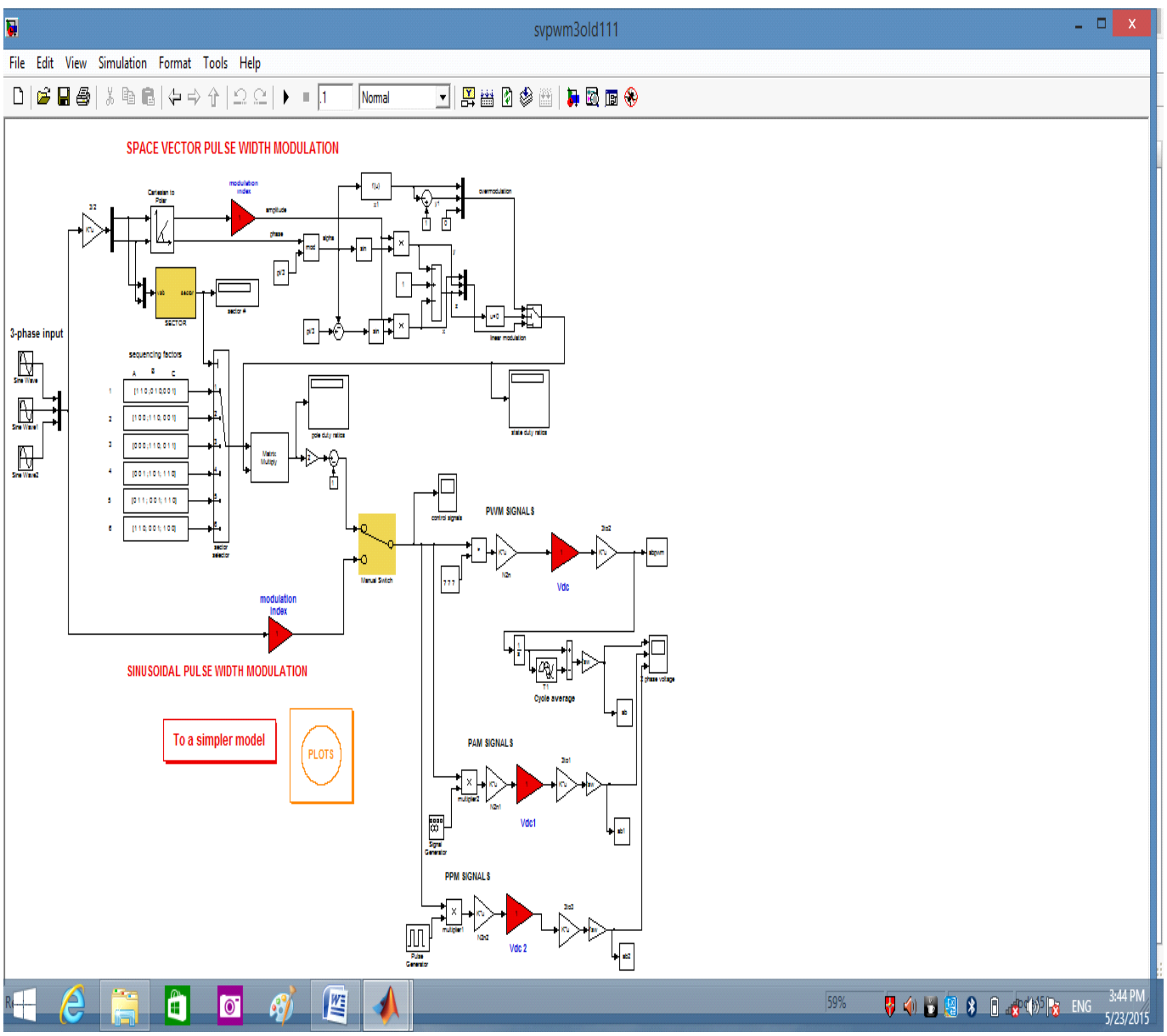

Fig.6 simulink model of PAM, PWM, PPM with SVPWM

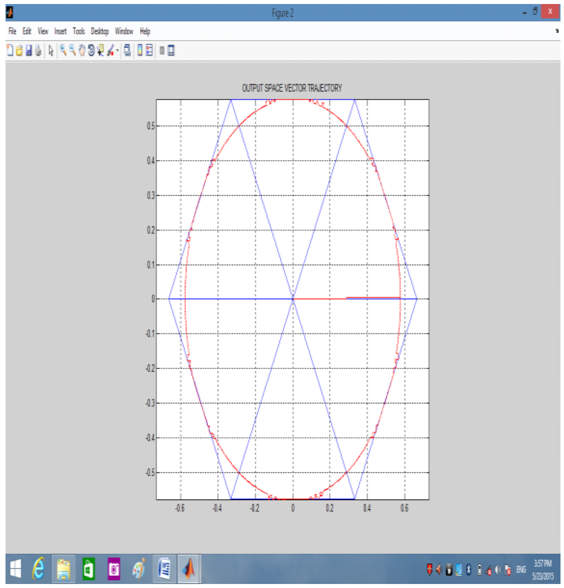

Figure.7 Represents locus comparison PWM and SVPWM

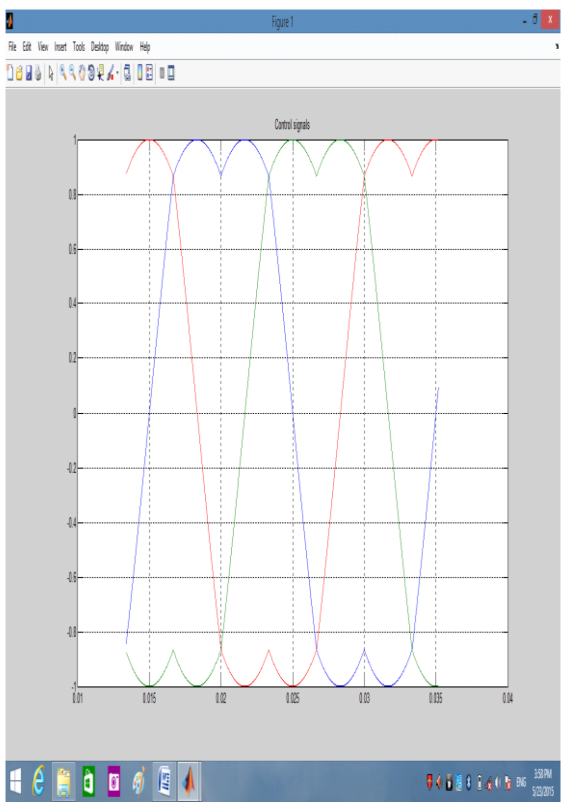

Figure.8 Represents control signal.

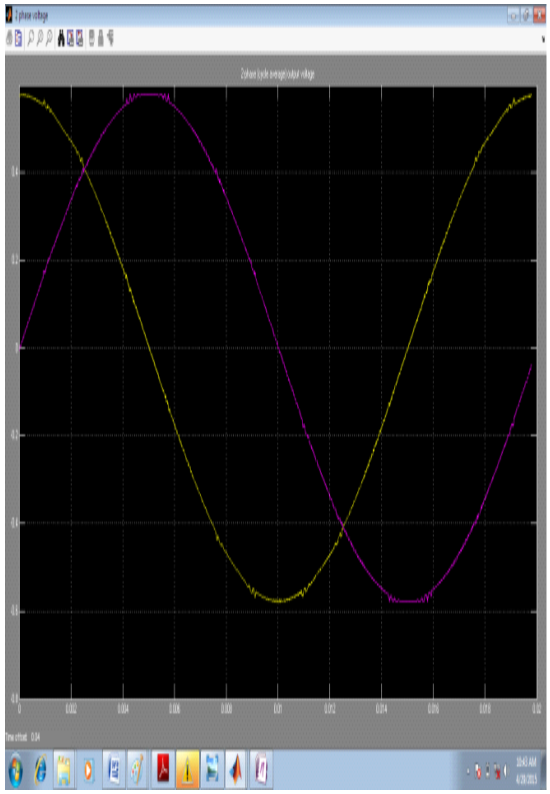

Figure.9 Represents 2-phase voltage

V. SIMULATION RESULT

We analyze PWM and SVPWM using MATLAB/SIMULINK model along with generation of PAM and SVPWM. The modulation index of SVPWM is higher than PWM and the output voltage increases by 15% more in case of SVPWM as compared to PWM.

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