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REDUCTION OF HARMONIC DISTORTION AND SWITCHING LOSSES OF INVERETR BY SINUSOIDAL PULSE WIDTH MODULATION

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ABSTRACT

The new switching sequence can be used for space vector-based pulse width modulation (PWM) of voltage source inverter. Evaluate and compare different switching sequences interns of inverter switching losses. A hybrid PWM technique named minimumswitching loss PWM is proposed, which reduces the inverter switching loss compared to conventional space vector PWM (CSVPWM) and discontinuous PWM techniques at a given average switching frequency. Compared with CSPWM, four space vector-based hybrid pulse width modulation techniques are helped to reduce line current distortion and switching losses in motor drives.

INTRODUCTION

a modulation technique used to encode a message into a pulsing signal. Although this modulation technique can be used to encode information for transmission, its main use is to allow the control of the power supplied to electrical devices, especially to inertial loads such as motors. In addition, PWM is one of the two principal algorithms used in photovoltaic solar battery chargers, the other being MPPT.

The average value of voltage (and current) fed to the load is controlled by turning the switch between supply and load on and off at a fast rate. The longer the switch is on compared to the off periods, the higher the total power supplied to the load. The PWM switching frequency has to be much higher than what would affect the load (the device that uses the power), which is to say that the resultant waveform perceived by the load must be as smooth as possible. Typically switching has to be done several times a minute in an electric stove, 120 Hz in a lamp dimmer, from few kilohertz (kHz) to tens of kHz for a motor drive and well into the tens or hundreds of kHz in audio amplifiers and computer power supplies.

The term duty cycle describes the proportion of 'on' time to the regular interval or 'period' of time; a low duty cycle corresponds to low power, because the power is off for most of the time. Duty cycle is expressed in percent, 100% being fully on. The main advantage of PWM is that power loss in the switching devices is very low. When a switch is off there is practically no current, and when it is on and power is being transferred to the load, there is almost no voltage drop across the switch. Power loss, being the product of voltage and current, is thus in both cases close to zero. PWM

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also works well with digital controls, which, because of their on/off nature, can easily set the needed duty cycle. PWM has also been used in certain communication systems where its duty cycle has been used to convey information over a communications channel.

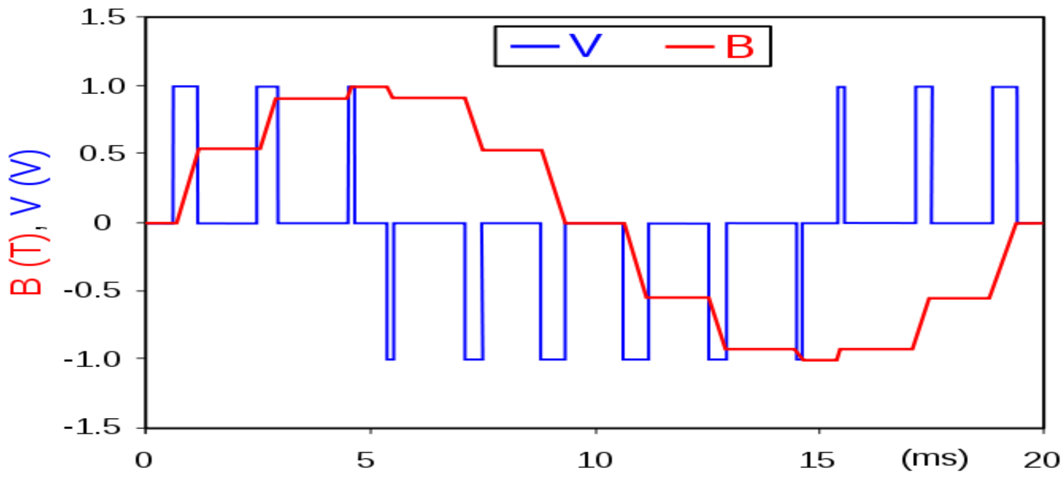

Fig 1 wave for combined positive and negative pulse

An example of PWM in an idealized inductor driven by a voltage source: the voltage source (blue) is modulated as a series of pulses that results in a sine-like current/flux (red) in the inductor. The blue rectangular pulses nonetheless result in a smoother and smoother red sine wave as the switching frequency increases. Note that the red waveform is the (definite) integral of the blue waveform.

PROPOSED SYSTEM

The **Pulse Width Modulation** is a technique in which the ON time or OFF time of a pulse is varied according to the amplitude of the modulating signal, keeping t

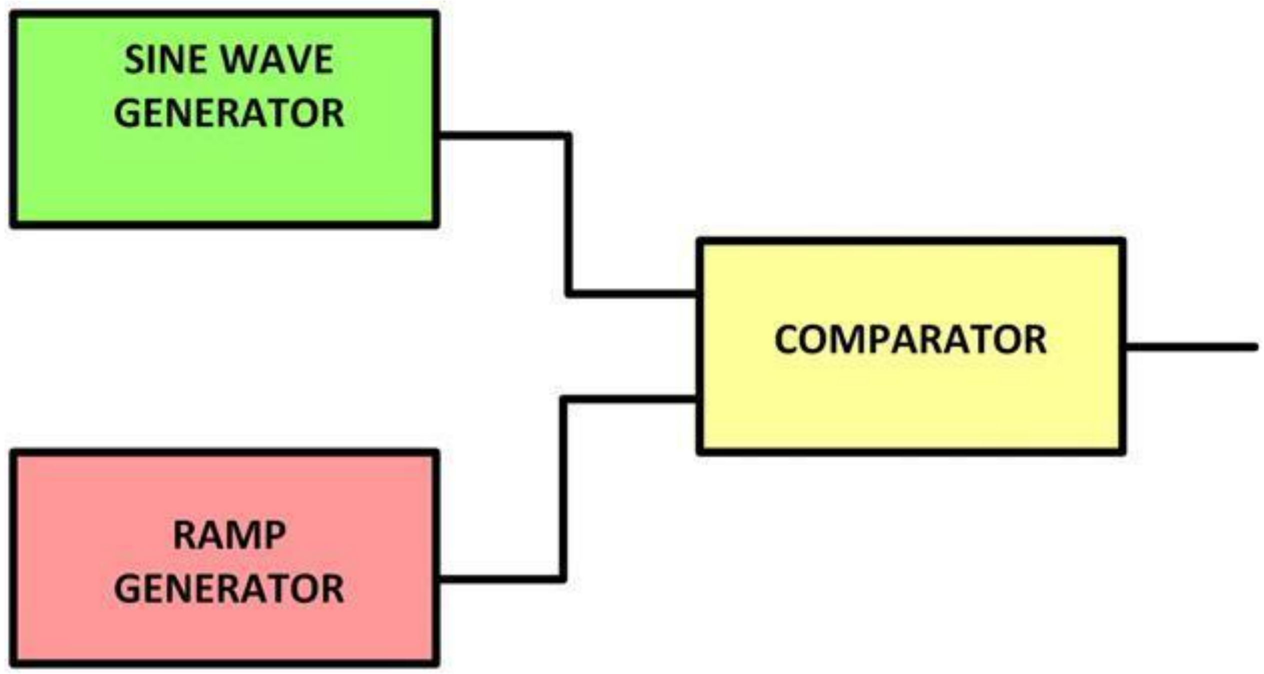

Fig 2 SPWM block diagram

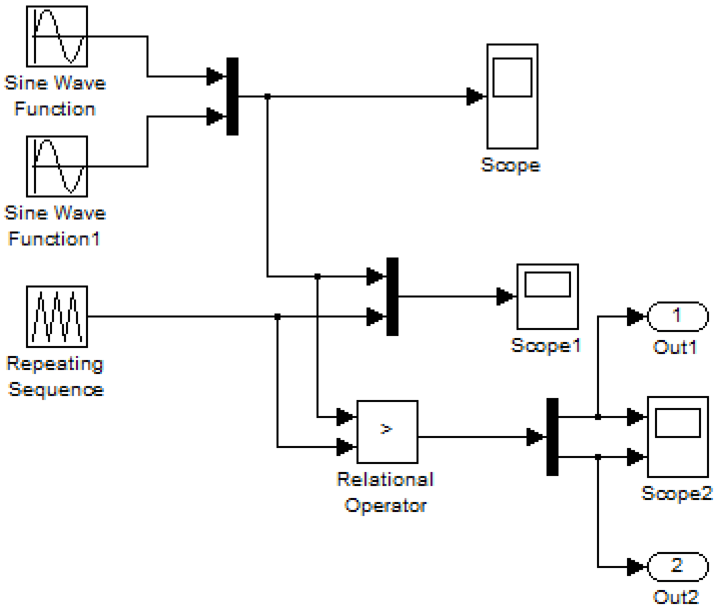

Fig 3 SPWM SIMULATION DIAGRAM

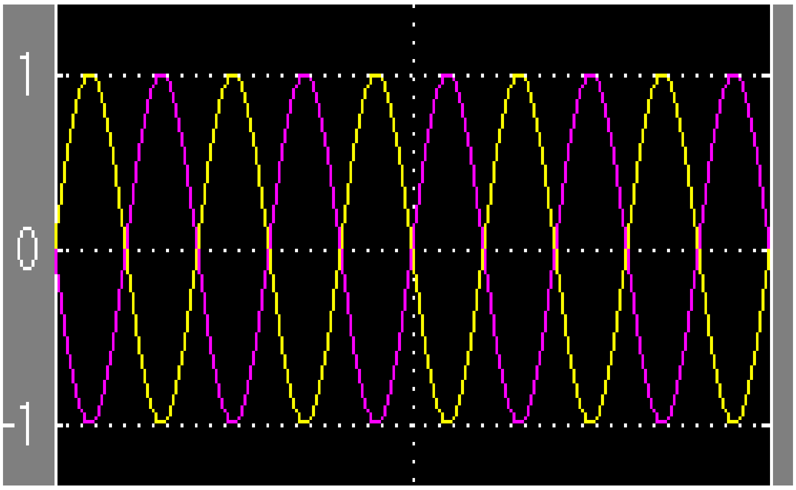

Fig 4 SCOPE view

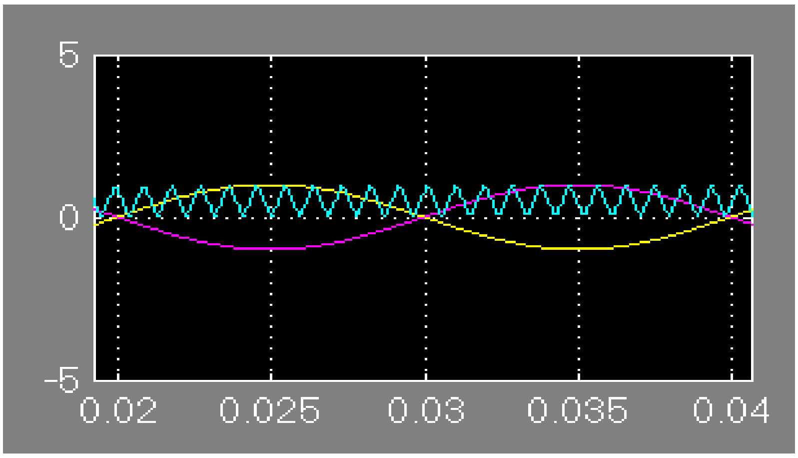

Fig 5 SCOPE 1 view

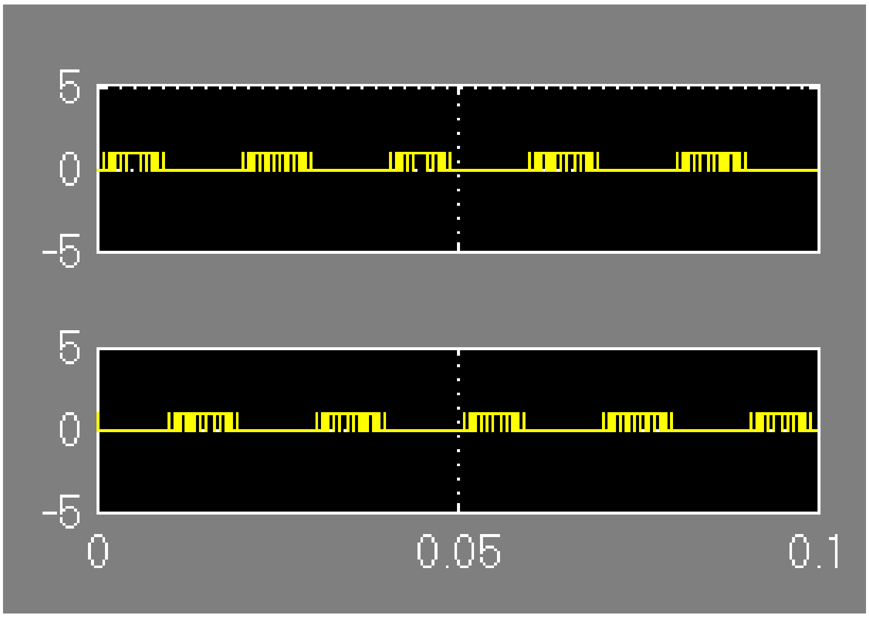

Fig 6 SCOPE 2 view

the (ON time + OFF time) time of the pulse as constant. The (ON time + OFF time) of a pulse is called ‘Period’ of the pulse, and the ratio of the ON time or OFF time with the Period is called the ‘Duty Cycle’. Hence the PWM is a kind of modulation which keeps the Period of pulses constant but varying their duty cycle according to the amplitude of the modulating signal.

The conventional method of generating a PWM modulated wave is to compare the message signal with a ramp waveform using a comparator. The block diagram required for the generation of a simple PWM is shown

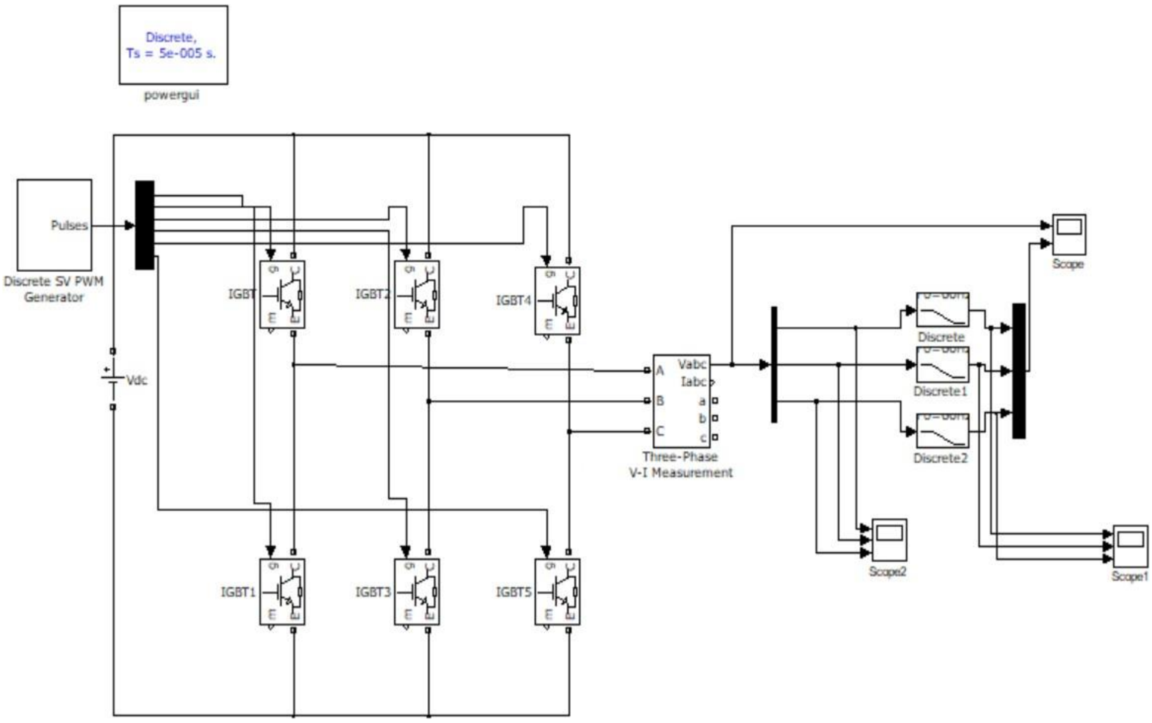

Fig. 7: Proposed inverter with SVPWM

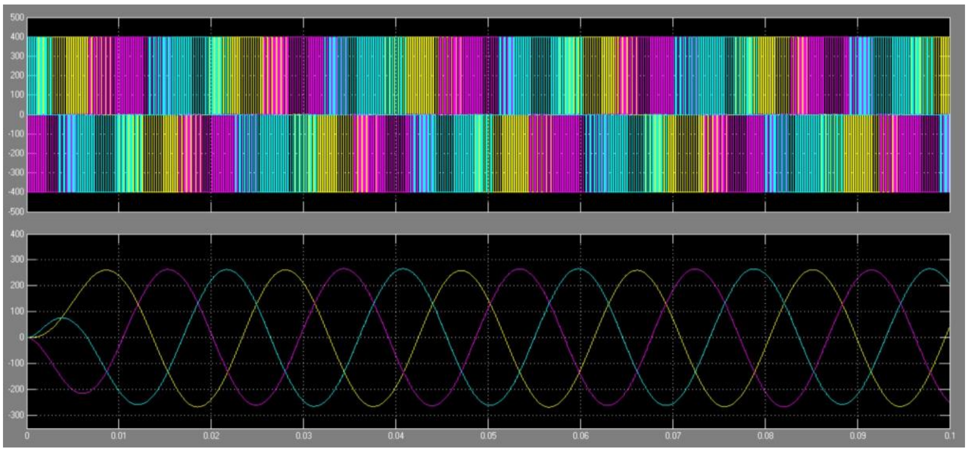

Fig. 8: Inverter voltage before and after filter with SVPWM

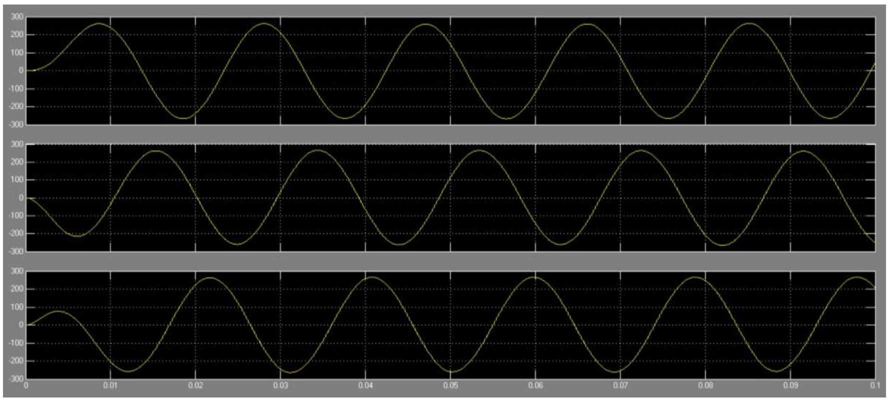

Fig. 9: Three individual voltages at inverter output with SVPWM

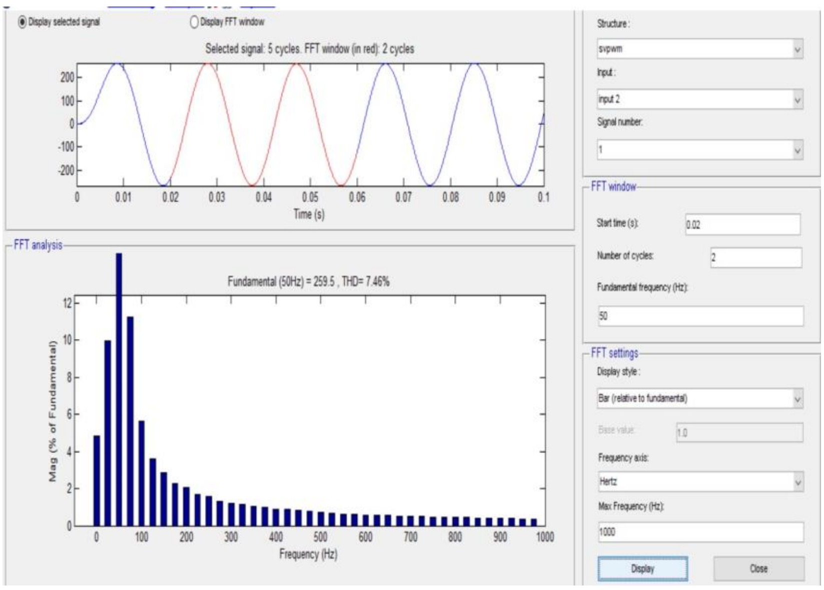

Fig. 10: Inverter voltage after filter THD with SVP

ADVANTAGES

1. It reduces the harmonic distortion
2. Higher DC bus efficiency
3. Variable frequency control
4. Voltage magnitude control
5. Low switching losses
6. It provides better power factor

APPLICATIONS

SVPWM is a technique used in the final step of field-oriented control (FOC) to determine the pulse-width modulated signals for the inverter switches in order togenerate the desired 3-phase voltages to the motor.

CONCLUSION

A comparative analysis is carried out with sin pulse width modulation andspace vector pulse width modulation with two level IGBT based ac to dcconverter, as a result than compared with the SVPWM modulation process SPWM based inverter produces less amount of distortion. Total simulation resultsare carried out in MATLAB 2009a software under power graphical user interface.

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