MODIFYING HYBRID MULTILEVEL INVERTER EMPLOYING BY USING PWM AND PI CONTROL TECHNIQUES

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Abstract: Multilevel inverter (MI) was known as an intelligent topology conversion form low to high voltage DC-AC Inversion. This paper introduces a form of hybrid multilevel inverter using proportion integer (PI) controller. This modifying technique employs the sine wave modulation inverted such the carrier waveform. Gate signals are activated by a PI controller, also, the "sinusoidal PWM control technique has been actuated in the circuit to provide an acceptable control level in the inverter output voltage". The performance of the present technique has been simulated by the state of different charge. The integral control training simulator relative to the reflector unit step proposed amendment to the strategy is made by MATLAB / SIMULINK.

Keywords: *Multilevel Inverter, Total Harmonic Distortion, PI Controller, Sinusoidal pulse width modulation, Switching.*

(تعديل العاكس الهجيني ذو المستويات المتعددة باستخدام تقنية تعديل عرض النبضة والمتحكم التناسبي التكاملي)

الخلاصة: ان العاكس ذو المستويات المتعددة والمعروف عنه عبارة عن هيئة او شكل ذكي في التعامل مع الفولتيات العالية من خلال عكس الفولتيات المستمرة الى الفولتيات المتناوبة. هذا البحث يعمل على بناء جديد للعاكس باستخدام PI ,ان هذا التغيير في التقنية يستعمل للحصول على موجة جيبية متناوبة خالصة.ان دائرة القدح او ماتسمى اشارات القدح للترانستور تفعل عن طريق المتحكم التناسبي المتكامل (PI) وكذلك يمكن استخدام تقنية (PWM)للحصول على موجية جيبية خارجية نقية. ان اداء النظام يعتمد على فحص لعدة اشارات قدح على قاعدة الترانستور وكان الاداء جيد جدا.

1.Introduction

The demand for electrical power input to improve, enhance energy production in the age of semiconductor devices capable of handling. However, the contraction of applications using a single, high power semiconductor devices, while supporting a maximum voltage still a problem [1] . Performance is a multi-level inverter which generates a DC input voltage, output voltage prefer different levels [2]. As the number

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of levels increases, the output waveform is synthesized more stages, that generates a staircase wave wave generation is the preferred method. They especially in the area of distributed energy resources because of a few batteries, fuel cells, solar cells and wind turbines can be connected via a multi-level inverter voltage load balancing are important to the smooth [3]. There are several topologies of multilevel inverter like Multilevel Diode Clamped/Netural Point Inverter (NPCMLI), Multilevel Capacitor Clamped/Flying Capacitor Inverter (CCMLI), Cascade Multilevl Inverter (CMI) and Generalized P2-Cell Multilevl Inverter (GMLI)…etc[4].

The proposed topology advantages over existing reducing the number of switches, fewer capacitors, simple construction and permits the use of a current source. After a multi-level diversification of investments has been informed waterfall near the modulation modulation based on support vector space and the most common [5]. Several methods have been proposed to reduce distortion multiple carriers in a multi-level inverter, based on traditional sinusoidal pulse width modulation (SPWM) vehicles with triangular [6]. However, this article is based on a modulation technique two reference waveforms with a sine wave inverter carrier focused. The advantages of increased basic voltage sine wave inverter, reducing total harmonic distortion (THD) and switching losses [7, 8]. However, this article is based on a modulation technique two reference waveforms with a sine wave inverter carrier focused. The advantages of increased basic voltage sine wave inverter, reducing total harmonic distortion (THD) and switching losses [9, 10]. Occurs whenever the reference pulse amplitude sine wave is larger than the inverse sine carrier wave.

The microcontroller is used to obtain the gate pattern for isolation gate bipolar transistor (IGBT) [11]. Supply voltage inverter (PV), which is at the heart of a photovoltaic system, is used to convert DC power from photovoltaic modules into alternating current to be fed into the grid. Purification of the output waveform of the inverter to reduce harmonics of the individual and, thus, the size of the filter used and the level of electromagnetic interference (EMI) generated by the conversion process. This year, the multilevel converter more attractive to researchers and manufacturers because of its benefits over the conventional PWM inverters have become Tuesday. Expand output waveform, smaller size and less filter EMI, low total harmonic distortion (THD) [12].

In this paper, a single-phase bridge cascade multilevel inverter with three H-bridges is recommended. Sinusoidal PWM control method is adopted to provide a satisfactory control trip circuit of the output voltage of the inverter [13]. PI controller to control the system to obtain the necessary output voltage. In addition, PI controller is used to control using PWM proposed MLI [14]. It should be noted that the results of modulation strategy in the switching losses THD less choice to offer compared with conventional methods. The software MATLAB / SIMULINK in this paper to simulate the power and control circuits. Output voltage waveform and harmonic spectrum has already been presented and analyzed the output voltage. The exact method proposed regulation takes place through software MATLAB / SIMULINK by switching losses and THD.

2. Current Controller using PWM for Multilevel Inverters

The three bridge cascade multilevel inverters using a PI controller in this section are discussed and shown in Figure 1a, 1b, 1c and 1d. The circuit requires an independent source of DC power from the photovoltaic (PV) array. Gate signals using pulse width modulation sine wave.   The output of the inverter bridge cascade of three bridges and 27 level to load the feed to produce a sinusoidal output, compared with the reference voltage to produce an error signal. PI controller output signal to the reference signal added to compensate for signal modulation is required to produce gating pulses.

Therefore, a voltage feedback loop is recognized to realize sinusoidal output voltage is required. So, whenever God nonlinear distortion in the output increases. The error between the reference and the load current is measured by the PI controller for the production of the reference voltage. Modulation is required to generate signals for inverter switch. The charging voltage is compared with a reference to a triangular carrier signal, and output is used to drive any comparison waterfall H- bridge (CHB) multilevel inverter.
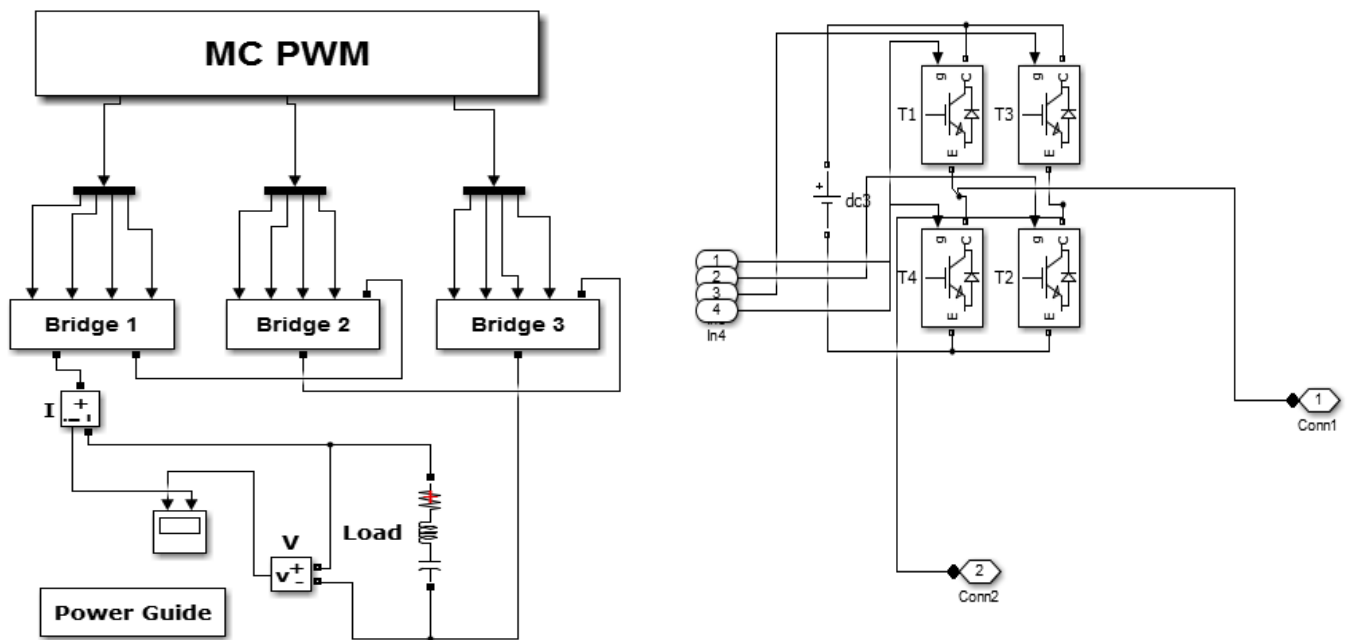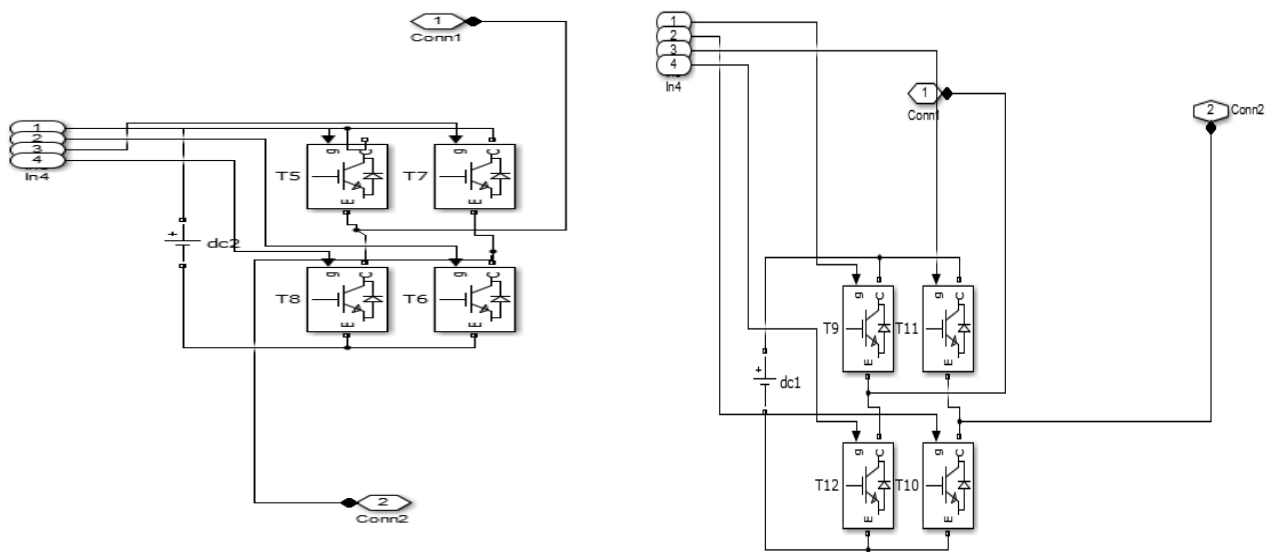

Figure 1a :Main Circuit

Figure.1 The Circuit Diagram for Multilevel Inverter.

3. Harmonic Reduction by uses PWM Technique

Many modulations for multilevel converters has been proposed. The most common method is sinusoidal PWM. Sinusoidal pulse width modulation method is used here without affecting the low order harmonics multilevel inverter to control the output voltage. The modulation method uses a carrier wave at a high switching frequency compared to the reference sine wave output switching frequency. The intersection between these two signals are defining moments switching pulse SPWM.

4. Simulation Results

"In this paper the load which used for simulation results is an RL, RC and RLC load and the input DC voltage, VDC = 25, 75 and 225 V.Then the following results can summarized as below":

➤ "The simulation model is implemented by using MATLAB/SIMULINK in Figure 1. And suggested circuit needs an independent DC source which is" provided.

➤ Simulated output (o/p) voltage and output current are shown in Figures 2,4 and 6.

➤ THD analysis for 27 levels cascaded 3 h-bridge inverter are present in Figures 3,5 and 7.

Compare current PI controller with hysteresis control its flow with the changes once done by the current THD. The whole harmonic load flow analysis waveforms Fast Fourier Transform (FFT) is used in total once the current RL, RC and RLC harmonic distortion is measured so,

- Figure.2. Show the output voltage and current waveforms when load resistance 20Ω and inductance 10mH.
- Figure.3. Show the FFT Analysis of Source Current (THD=4.69) when load resistance 20Ω and inductance 10mH.
- Figure.4. Show the output voltage and current waveforms when load resistance 20Ω and Capacitance 1micro F.
- Figure.5. Show the FFT Analysis of Source Current (THD=6.47) when load resistance 20Ω and Capacitance 1µF.
- Figure.6. Show the output voltage and current waveforms when load resistance 20Ω , inductance 10mH and capacitance 1µF.
- Figure.7. Show the FFT Analysis of Source Current (THD=8.66) when load resistance 20Ω , inductance 10mH and capacitance 1µF.

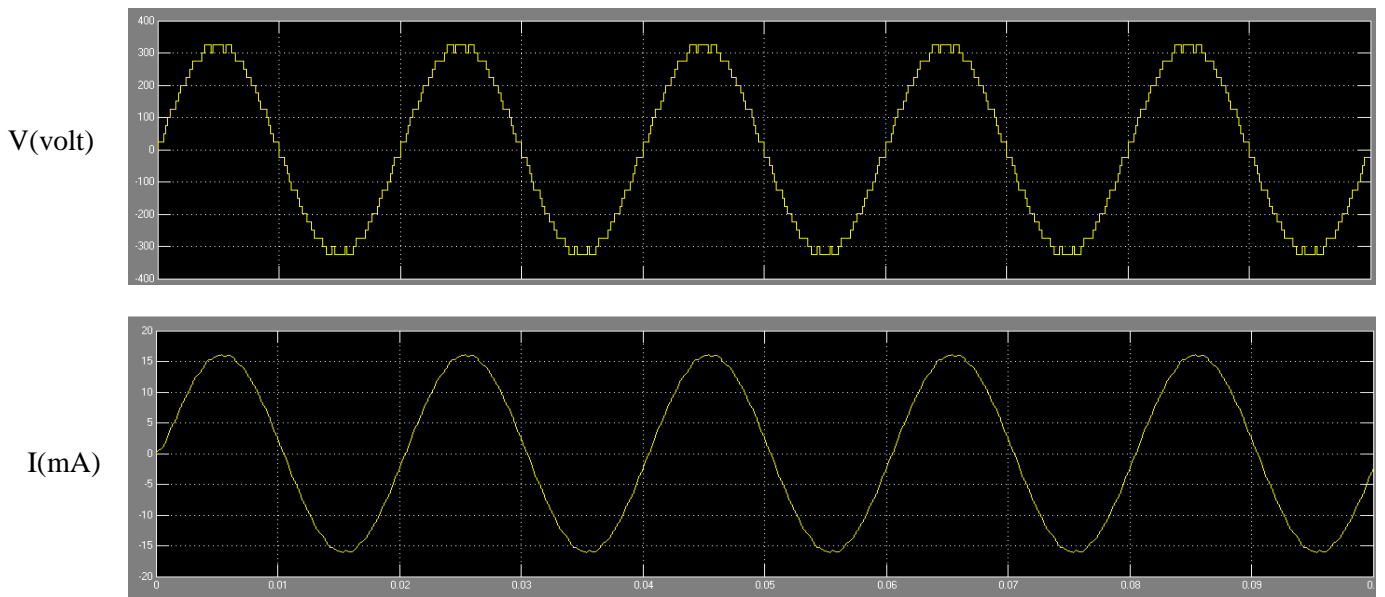

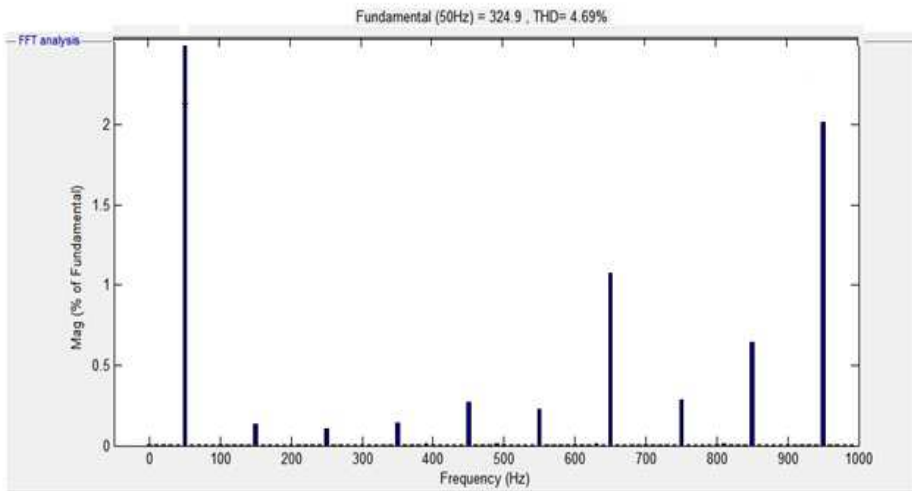Figure.2.Output voltage and current waveforms with load resistance 20Ω and inductance 10mH.

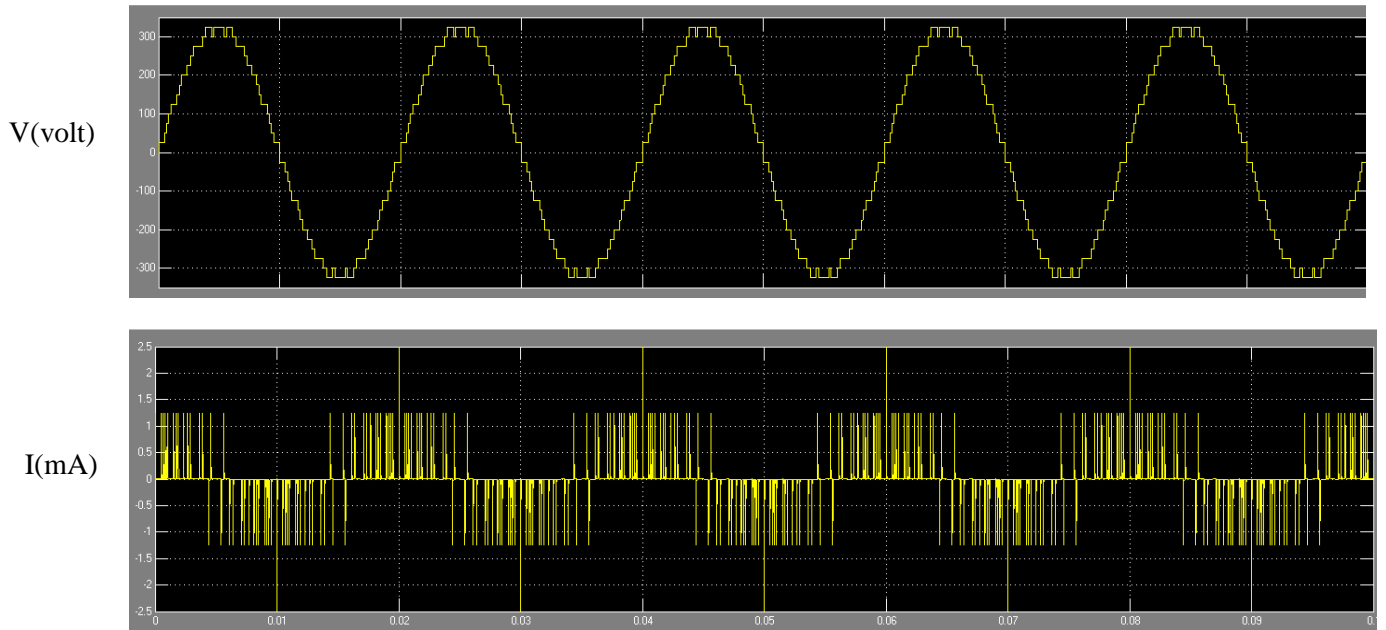Figure.3. FFT Analysis of Source Current (THD=4.69) with load resistance20Ω and inductance 10mH.

Figure.4.Output voltage and current waveforms with load resistance 20Ω and Capacitance 1µ F.
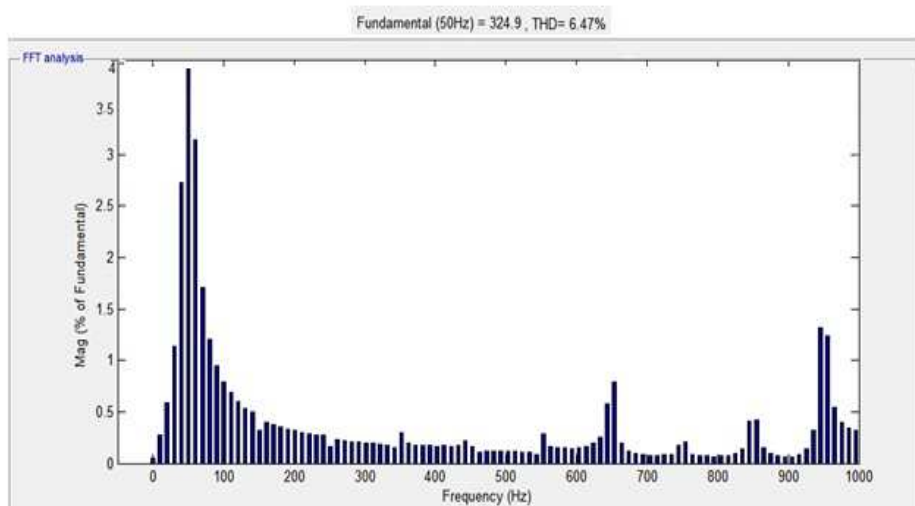

Figure .5. FFT Analysis of Source Current (THD=6.47) with load resistance 20Ω and Capacitance 1µ F.

Various parameters of the PI controller were tested for performance-based circuits with PWM techniques are discussed. Comparison results are shown in Table 1.

Table 1.Comparison results

Different Loads	THD
"R=20 Ω , L=10mH"	4.69%
"R=20 Ω,C=1 µ F"	6.47%
"R=20 Ω, L=10mH, C=1 µ F"	8.66%

5. Conclusion

Three bridge cascade multilevel inverters using a model of software Matlab / SIMULINK are executed. The effect of introducing a PI controller to improve performance inverter. The sinusoidal PWM control method has been adopted in the circuit to provide acceptable control of output voltage inverter. As the amount of time that alternative THD value when the coil with a capacitor and the increase in value when considering an induction time of RLC large bulk capacitor (increase increase current peak). Simulation results show that this method of control with this investment, significantly reduced harmonics.

6. References

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