International Journal of Power Electronics and Drive Systems (IJPEDS)
Vol. 12, No. 1, Mar 2021, pp. 212~216
ISSN: 2088-8694, DOI: 10.11591/ijpeds.v12.i1.pp212-216

Simulation model of single phase PWM inverter by using MATLAB/Simulink

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Article Info

Article history:

Received Mar 7, 2020
Revised Jan 20, 2021
Accepted Feb 1, 2021

Keywords:

Inverter
LC filter
Power electronic
PWM

ABSTRACT

This work is presenting under the title simulation model of single phase PWM inverter by using MATLAB/Simulink. There are many researchers' works in this field with the different ways because it is important field and it has many applications. The converter DC power to AC power for any system that mean it need the power electronic device (inverter). The inverter is using when the source DC power and the load AC power. In this work, the simulation system includes the source 300V DC power, inverter, LC filter and load (R). The simulation result shows the waveform of all part in this system like input and output current and voltage.

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1. INTRODUCTION

Power electronic, there are four kind for power electronic device AC-AC, DC-DC, AC-DC and DC-DC [1]-[5]. The AC-AC is called converter also the DC-DC is called converter, the AC-DC is called rectifier and DC-AC is called inverter that device is using in this work [6]-[9]. Inverter, it uses to convert DC power to AC power for any system [10]-[12]. The inverter is one of the parts of the renewable energy systems (wind energy or the photovoltaic system) and has many industrial applications such as UPS [13]-[15]. Adopting the pulse width rate to control the output voltage of the inverter through the stimulation pulses of the inverter switch gates [16]-[21]. The inverter voltage changes with the change in load, so I found the need for a control process to stabilize the voltage by controlling the inverter output (correcting and setting) according to the load value [22]-[26]. The current study includes a reflector with a pulse width rate, and the study is using a computer program that helps simulate the system designed for the current study. By setting different criteria to study different cases to determine the response of the system. Moreover, to address instabilities within the design boundaries of the system used and to reach the best model can give a high response and a short time.

2. THE SIMULATION MODEL

The Simulation model of single phase PWM inverter by using MATLAB as shown in Figure 1, that include voltage source (V_{DC}=300 V), LC filter (L=2 mH and C=11 microF), Load resitance (R=1 ohm), PWM as shown in Figure 2 and inverter as shown in Figure 3. The simulation model of PWM that had input & output, input (sine wave, sawtooth and comparative) and output had pulses. The simulation model of single

phase inverter that had input & output, input had (V_{DC} & pulses) and the output had V_{AC}. That the connected to input filter after filter connect to the load.

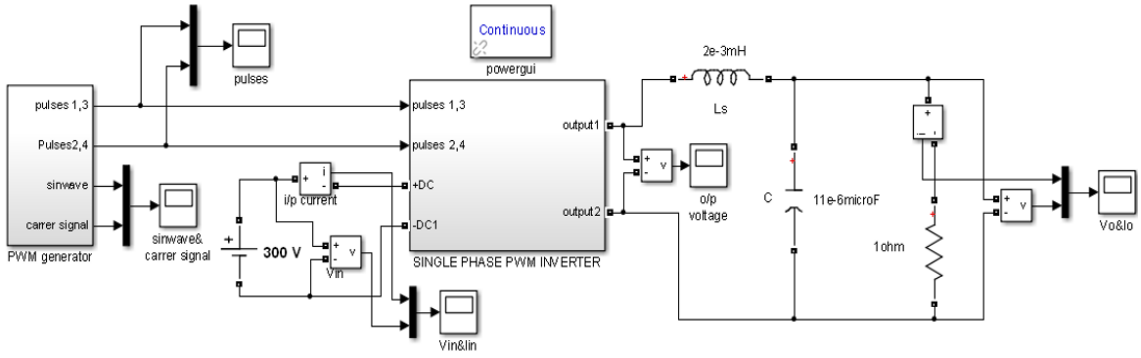

Figure 1. Simulink model of single phase PWM inverter

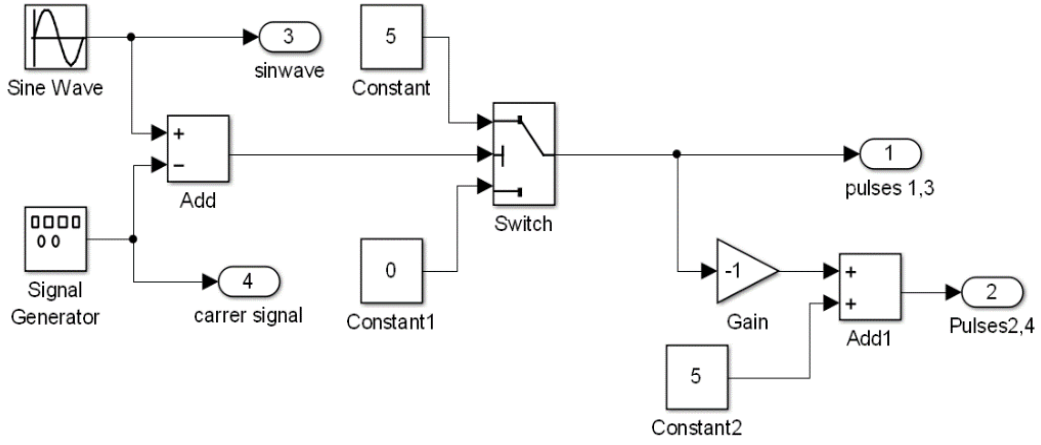

Figure 2. Simulink model of PWM

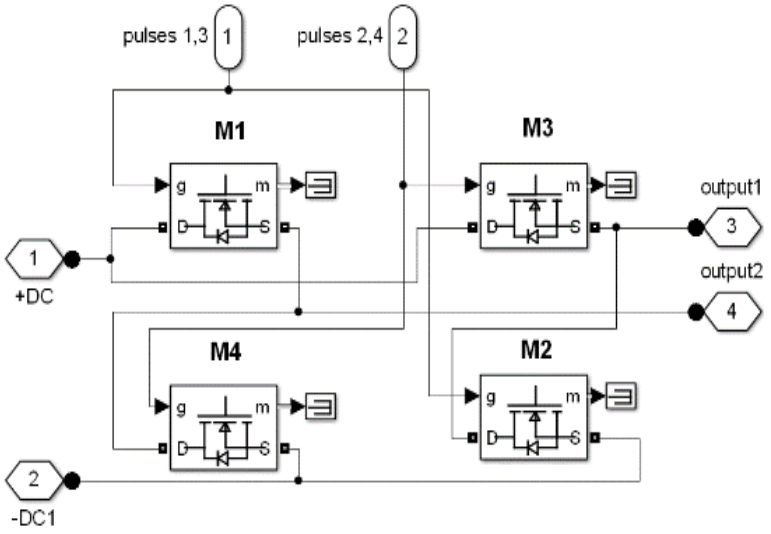

Figure 3. Simulink model of single-phase inverter

3. SIMULINK RESULTS

The Simulink results have many parts include simulink voltage and current input system as show in Figure 4, Simulink input filter as show in Figure 5 and simulink voltage and current output system as show in Figure 6.

3.1. Simulink voltage and current input system

In this part, the simulink voltage and current input system as show in Figure 4. By using 300 V_{DC} input to 100 V_{AC} output. Options have been developed to conduct the test for the proposed system that adopts the circuit feeding a 300 volt continuous voltage source to obtain experimental results as in the figure above, the result in Figure 4. Show the input voltageVin= VDC=300 Volts and input current Iin (A).

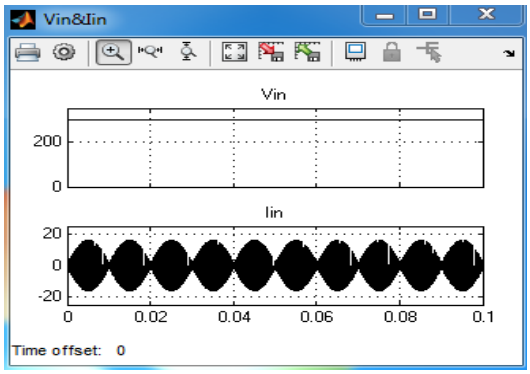

Figure 4. Simulink result of voltage and current input system

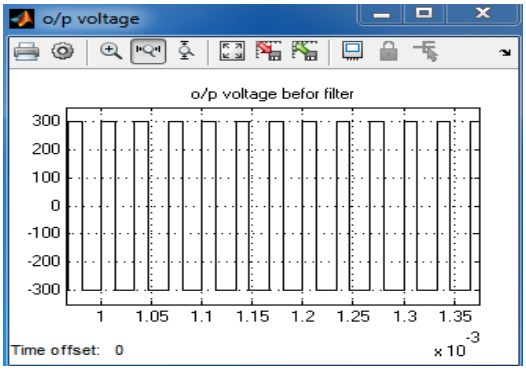

Figure 5. Simulink result for voltage of input filter

3.2. Simulink voltage of input filter

In this part, the Simulink input filter as show in Figure 5. The second stage is the candidate whose income is the output of the first stage, which can be obtained through the results shown in Figure 5. That show the output voltage before filter.

3.3. Simulink voltage and current output system

In this part, the simulink result voltage and current output system as show in Figure 6. By using 300 V_{DC} input to 100 V_{AC} output (DC to AC PWM), LC filter (L=2 mH& C=11 microF) and load (R) in ohm.

3.4. Simulink pulses and carrer signal

In this part, in simulation of DC to AC PWM inverter. In this simulation model consisting of four mosfet that had amplitude gate pulses 5 V selected Mosfet with 1 kHz frequency switching. The simulink pulses in Figure 7, sine wave in Figure 8 and carrer (sawtooth) signal as show in Figure 9.

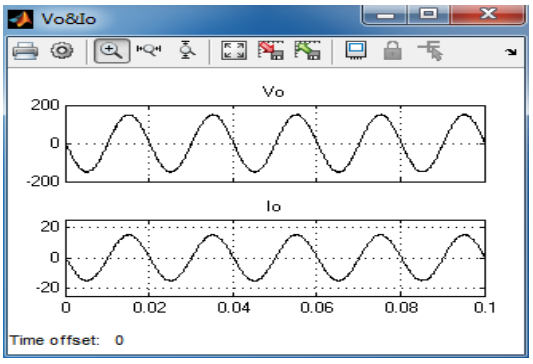

Figure 6. Simulink result of voltage and current output system

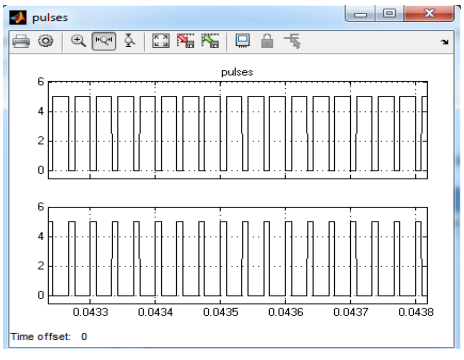

Figure 7. Simulink pulses

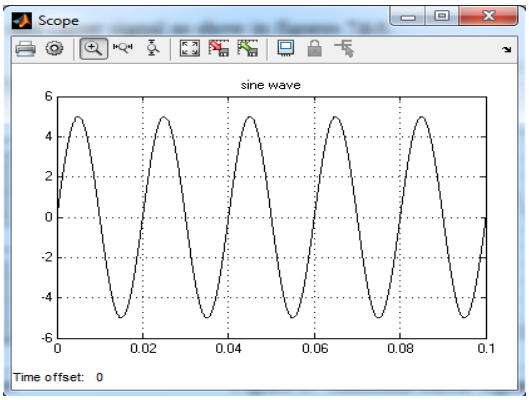

Figure 8. Simulink sine wave

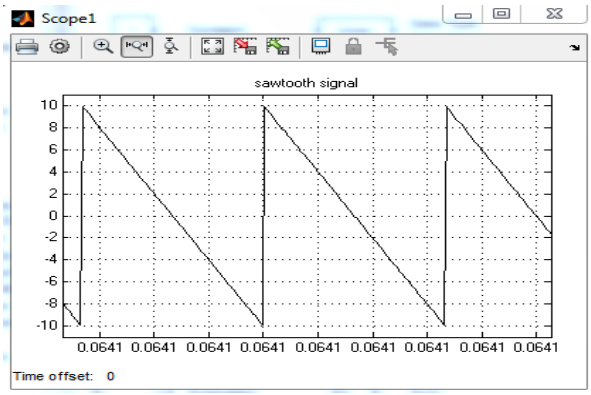

Figure 9. Simulink carrer signal

4. CONCLUSION

The characteristic of this system includes first the parameters of DC-AC inverter like switching type diode, transistor or thirestor. Second, the characteristic of PWM like amplitude value and frequency. Finally, the filter and load characteristic and types like LC filter and Rload. In simulation of DC to AC PWM inverter, selected Mosfet with 1 kHz frequency switching for 300VDC input to more than 100VAC output. Simulation of this proposed model for voltage regulation was conducted with the aim of validating system, simulation results show that the proposed system can be used effectively in many Applications that fit the specifications of the proposed system.

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