IMPLEMENTATION OF CONTINUOUS POWER SUPPLY SYSTEM FOR DOMESTTIC LIGHTING USING SOLAR BASED SPWM INVERTER AND DIESEL GENERATOR

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ABSTRACT

In this thesis describe details of fully automatic system for continuous power supply for domestic load .In which solar power, supply mains and diesel generator use as source .System gives output on the predefined priority. First priority is set on solar power , second priority is set on the supply mains and last one is on diesel power. For converting solar DC power in AC power SPWM base voltage source inverter used. For designing SPWM voltage source inverter IGBT bridge used and for generation for SPWM gate pluses reference sine wave compare with triangular wave . Performance of single phase SPWM inverter fed domestic load is described in detail.

INTRODUCTION

Normally in remote areas domestic lighting is done by either supply mains or by solar power but in bad weather condition solar power is not only sufficient for domestic lighting, So other option is supply mains but if both sources are unavailable at a time , so diesel powered generation system is alternative choice but presently domestic lighting system is done by manual system so there is problem with continuous lighting system at remote location. For short-out these problems implemented.

TABLE-01:- PRIORITY SELECTION FOR LOAD WITH DIFFERENT CASES.

Case	Solar Power	Supply Mains	Diesel Generator	Output Priority
01	0	0	0	No source
02	0	0	1	D/G set
03	0	1	0	Supply mains
04	0	1	1	Supply mains
05	1	0	0	Solar power
06	1	0	1	Solar power
07	1	1	0	Solar power
08	1	1	1	Solar power

Types of solar photovoltaic cells

Electricity is generated in solar cells which, as noted, consist of layers of semi conductive material. When the sun's rays shine down upon the sun cells, the electromotive force between these layers is being created, which reasons the go with the flow of power. As excessive the solar radiation intensity, more the flow of electricity.

The most not unusual material for the manufacturing of solar cells is silicon. Silicon is obtained from sand and is one of the maximum common elements within the earth's crust, so there may be no restriction to the provision of raw materials.

From different solar cell manufacturing technologies solar cells are:

Mono-crystalline

Poly-crystalline

Barcrystalline silicon

Thinfilm technology

[2]. Archan P. Parikh, P. N. Tekwani and Vinod Patel are proposed "Design and Implementation of Solar Pumping System with Induction Motor and Submersible Pump"

This paper proposed , induction motor along with submersible pump of 1.5 kW is used. On the basis of motor rating, solar panel rating is decided to be 1.8 kW considering losses in the system. In this system the main focus is to design boost- converter which boosts the voltage obtained from solar panel. This boost voltage acts as a dc-link voltage for three-phase inverter. Three-phase inverter is developed to convert dc voltage into ac voltage. This ac voltage generated is given to induction motor which runs the submersible pump. Maximum Power Point Tracking (MPPT) algorithm is implemented to obtain maximum power from the solar panel under different solar irradiation and temperature. In this topology, incremental conductance method is used to obtain maximum power from solar panel. Modulation index of inverter is controlled by Sine-Triangle Pulse Width Modulation (SPWM) technique[5].

SPWM

Main function of system is maintain continuity of output supply. For continuous power supply 3 different electrical sources used. That sources are solar panel, supply mains and diesel generator . With the help of switching setting of contactors first priority set on solar based SPWM inverter, second priority set on supply main and last priority set on diesel generator. IGBT based voltage inverter gated through SPWM gate pulses, The gating signals are produce by comparing a sinusoidal reference wave with a high frequency triangular signal.

The rms ac output voltage

$$V_o = V_s \sqrt{\frac{p\delta}{\pi}} \rightarrow V_s \sqrt{\sum_{m=1}^{2p} \frac{\delta_m}{\pi}}$$
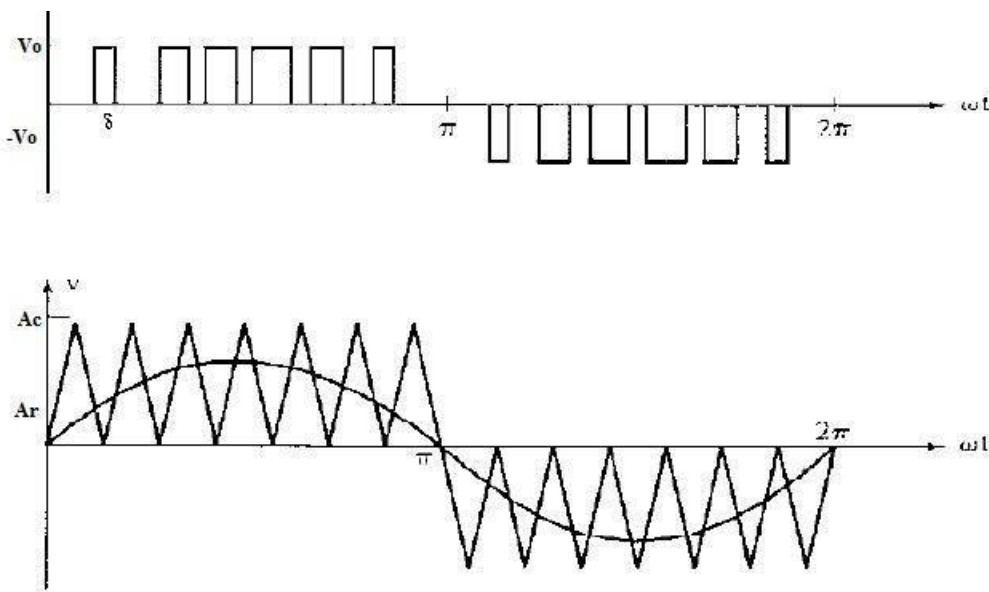
Where

p=number of pulses δ= pulse width

Figure 1: Sinusoidal Pulse Width Modulation

voltage sensor are used for sensing voltage level of supply mains and diesel generator, as the voltage comes is in normal range (200-240) so contactor is operated and on the basis of priority setting source is connected to domestic load system.
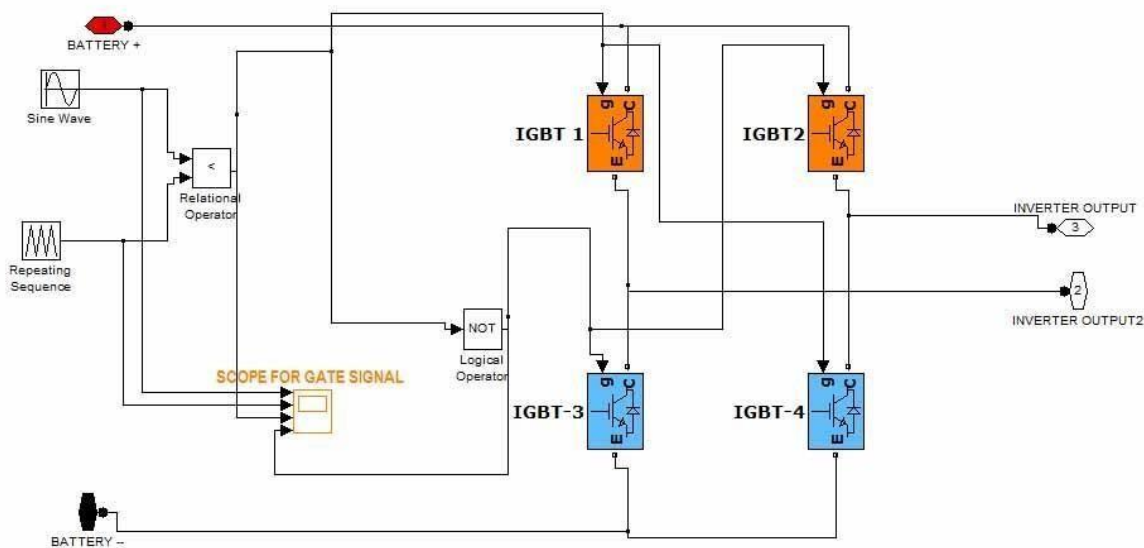
MODEL OF SPWM INVRTER

Figure 2:- Model Of SPWM Inverter

figure 2:- shows sub system of SPWM inverter block , In which gating signals are produce by comparing a sinusoidal reference wave with a high frequency triangular signal with the help of relational operator block, 4 IGBT with feedback diode are used for Bridge inverter, IGBT-1 & IGBT-4 works at same time and IGBT-2 & IGBT-3 works for next cycle. IGBT output of inverter collect from the terminal no. 2 and 3.

Results are obtained with solar powered SPWM single phase 1000VA MOSFET based inverter with 230v battery bank , which is connected to 4 different load For analysis of various electrical parameter.
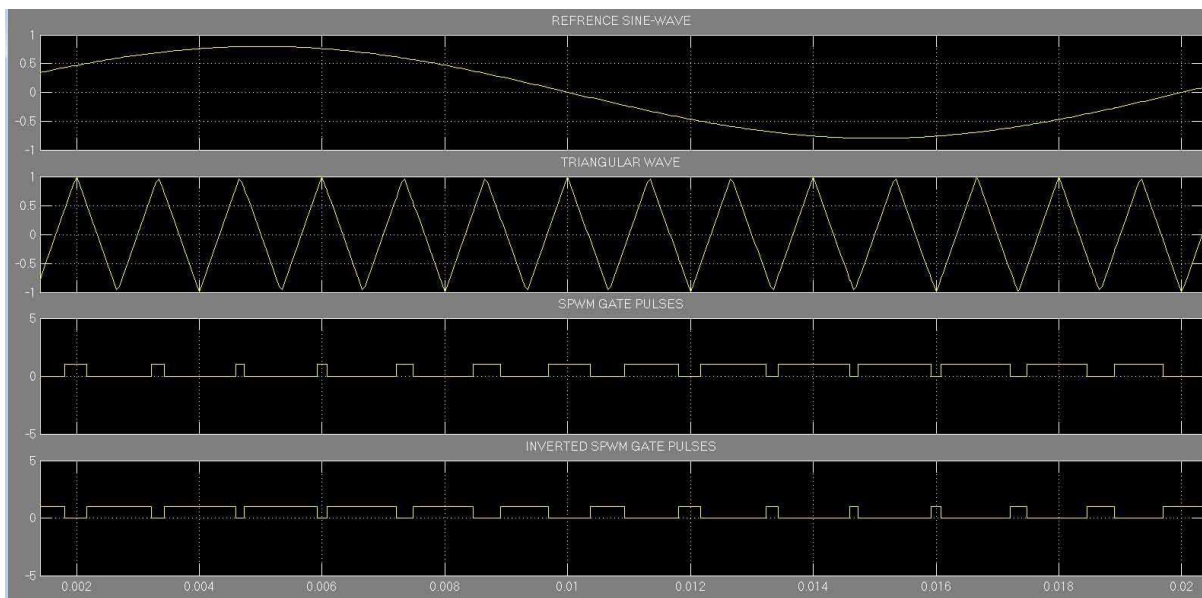
SPWM GATE PLUSE WAVE FORM
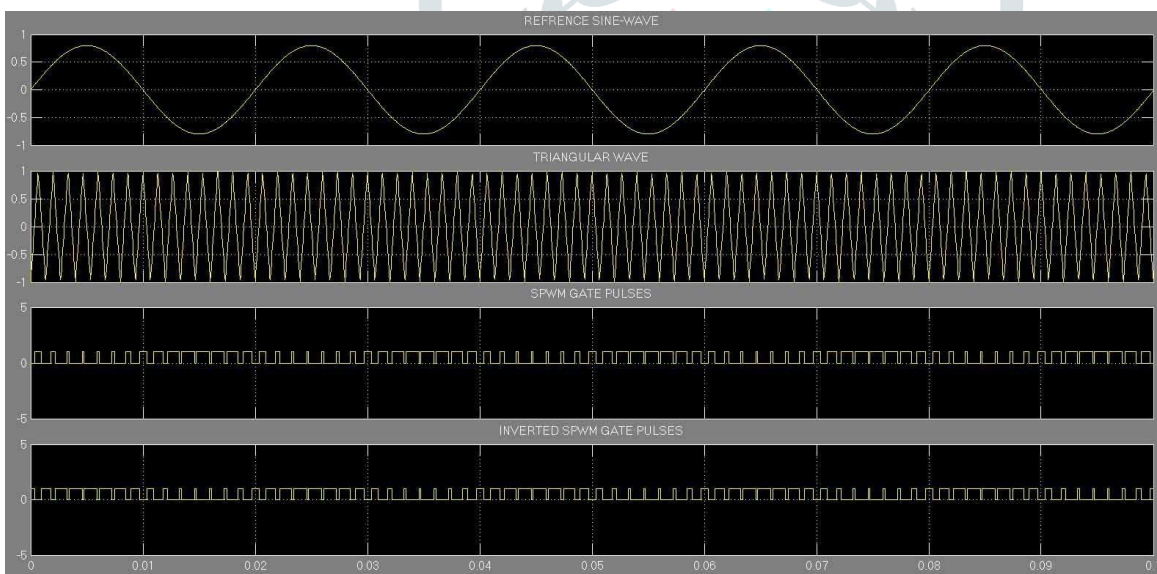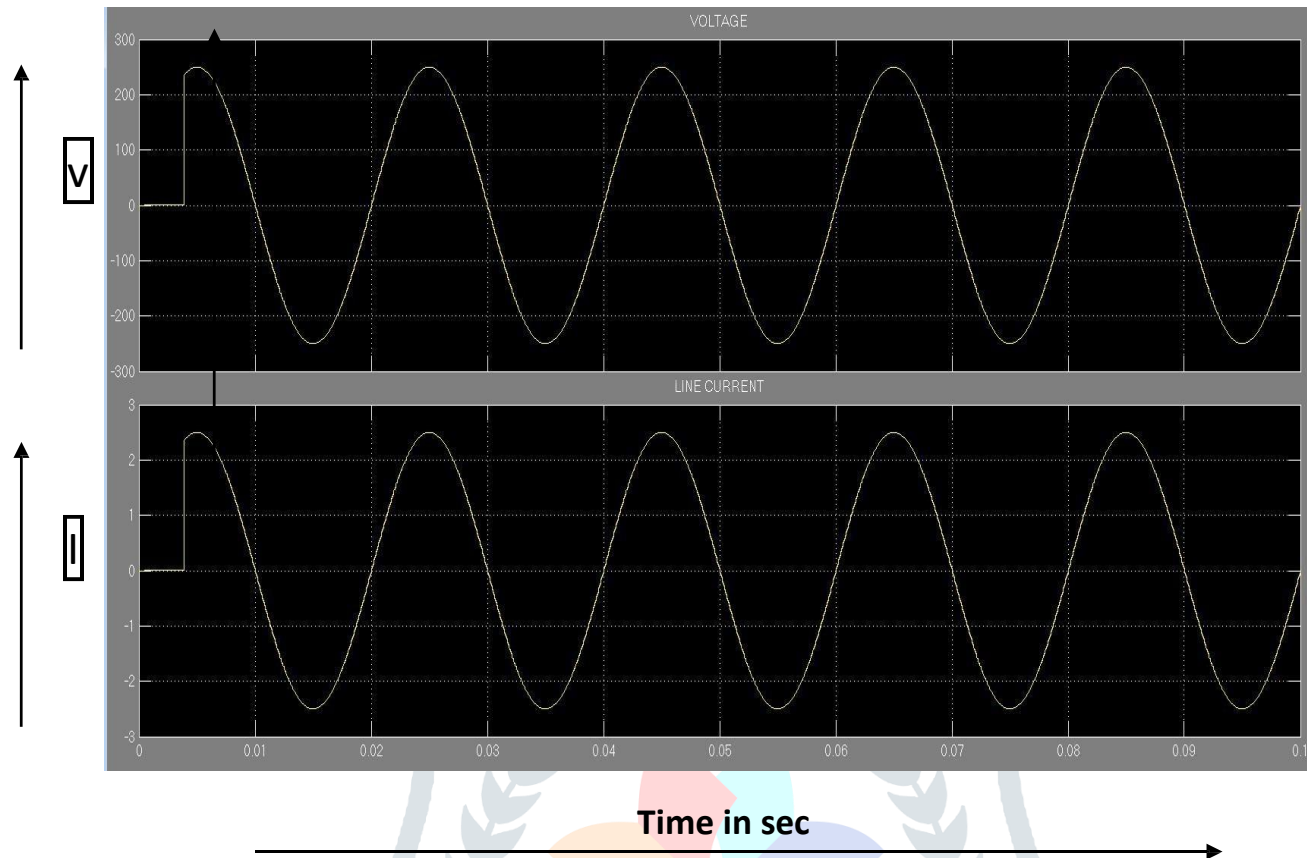

Figure 3:- SPWM Gate Pluse Wave Form For 1

Cycle

Figure 4:- SPWM Gate Pulse Wave Form in 0.1sec

CASE 1:- *100 ohms pure resistive load connected to inverter*

Time in sec

Figure 5:- voltage and current wave form under 100 ohm resistive load

Table 2- Output Parameter under 100 ohm resistive load

SN.	PARAMETER	VALUE
1	Vdc	230V
2	Vac	229.8 V
3	Iac	2.298 AMP
4	LOAD	100 ohm

CONCLUSION

As per my dissertation problem "Implementation of Continuous Power Supply System for Domestic load Using Solar Based SPWM Inverter And Diesel Generator" has been design in Matlab 2010. First source priority set on solar power next one is on supply mains and last one is on diesel generator.SPWM inverter produces sine wave output .Which reduces harmonics content and power losses at load side.

References

[1]. Muhammad H. Rashid, "POWER ELECTRONICS HAND BOOK DEVICES, CIRCUITS, AND APPLICATIONS", Third Edition, ISBN 978-0-12-382036-5, Copyright C 2011,Elsevier Inc.

[2]. Bimbhra .P.S "Power Electronics" Khanna Publishers, New Delhi, 2003. 4th Edition.

[3]. Umesh S Magarappanavar and Sreedhar Koti, " Optimization of Wind- Solar- Diesel Generator Hybrid Power System using homer "international research journal of engineering and technology (IRJET), volume: 03 issue: 06 , pp. 522-526, june-2016.

[4]. Piyush Choudhary, Rakesh Kumar Srivatava and Somnath De " Solar Powered Induction Motor Based Water Pumping System: A Review of Components, Parameters and Control Methodologies" 2017 4th IEEE Uttar Pradesh Section International Conference on Electrical, Computer and Electronics (UPCON) GLA University, Mathura, Oct 26-28, 2017,pp. 666-674.

[5]. Archan P. Parikh , P. N. Tekwani and Vinod Patel," Design and Implementation of Solar Pumping System with Induction Motor and Submersible Pump" Nirma University International Conference on Engineering (NUiCONE),2017.

[6]. V R.Balaji and M.Sudha, " Solar Powered Auto Irrigation System" International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE) ISSN: 0976-1353, Volume 20 Issue 2 – FEBRUARY 2016, pp. 203-206.

[7]. Er.Upendra Singh, Mohit Vyas, Gaurav Sharma, Surender Pal Singh and Suleman Khan" Solar based smart irrigation system" International Journal of Recent Research Aspects ISSN: 2349-7688, Vol. 3, Issue 1, March 2016, pp. 105-108.

[8]. S. Harishankar, R. Sathish Kumar, Sudharsan K.P, U. Vignesh and T.Viveknath" Solar Powered Smart Irrigation System" Advance in Electronic and Electric Engineering. ISSN 2231-1297, Volume 4, Number 4 (2014), pp. 341-346.

[9]. Dr. Esther T. Ososanya, Dr. Sasan Haghani, Dr. Wagdy H Mahmoud and Dr. Samuel Lakeou, " Design and Implementation of a Solar-Powered Smart Irrigation System".122nd ASEE annual conference & exposition, June 14-15,2015, Seattle , WA. Paper ID #13224. Page 26.454.1- Page 26.454.15.

[10]. J. P. Castillo, C. D. Mafiolis, E. C. Escobar, A. G. Barrientos and R. V. Segura" Design, Construction and Implementation of a Low Cost Solar-Wind Hybrid Energy System" IEEE LATIN AMERICA TRANSACTIONS, VOL. 13, NO. 10, OCTOBER 2015,PP. 3304- 3309.