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Reactive power compensation for Solar pv system

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***Abstract* —This paper present reactive power compensation for grid connected solar pv system. In this modeling of smart inverter and a control strategy using dq0 transformation and statcom .here inverter using pwm control strategy to balance the power flow from pv panel to the grid and statcom compensate reactive power. In this pv system through we get the output voltage and buck boost converter using control the voltage.**

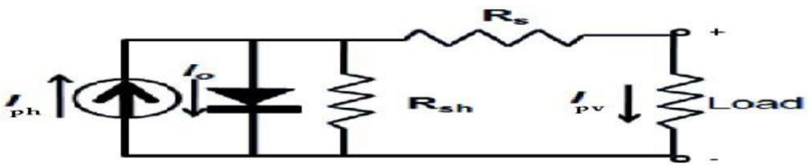
***Keywords*- pv system, buck boost converter, inverter,dq0 control, statcom, matlab**

I. INTRODUCTION

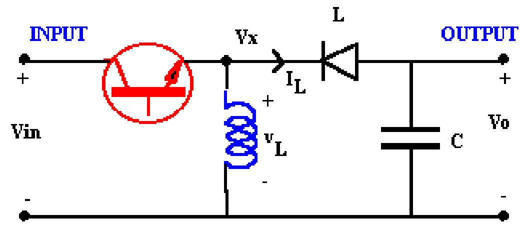
A An electric power system consists of generation, transmission and distribution of electricity. One of the most popular nonconventional energy sources is the solar energy. In this project we use the solar PV system and generate the power and connect the grid. Power as we know consists of two components active and reactive. The total sum of active and reactive power is called as apparent power. One of the main a major part is the reactive power in the system. Reactive power exists in an AC circuit. Reactive power is the power that supplies the stored energy in reactive elements capacitor and inductor. Inductors (reactors) are store or absorb reactive power and Capacitors are generate reactive power.

II. PV SYSTEM

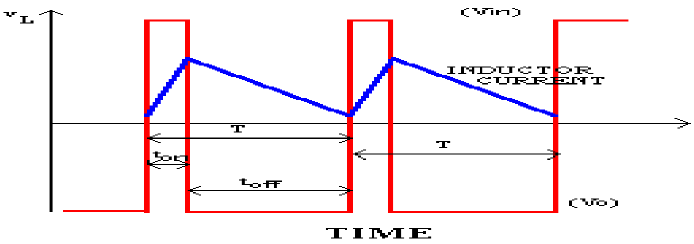
A solar cell is basically a p-n junction fabricated in a thin wafer of semiconductor. The electromagnetic radiation of solar energy can be directly converted to electricity through photovoltaic effect. Being exposed to the sunlight, photons with energy greater then the band-gap energy of the semiconductor creates some electron-hole pairs proportional to the incident irradiation. The equivalent circuit of a PV cell is as shown in Figure 1
The current source I_{ph} represents the cell photocurrent. R_{sh} and R_s are the intrinsic shunt and series resistances of the cell, respectively. Usually the value of R_{sh} is very large and that of R_s is very small, hence they may be neglected to simplify the analysis. PV cells are grouped in larger units called PV modules which are further interconnected in a parallel-series configuration to form PV arrays.



Buck boost converter



With continuous conduction for the Buck-Boost converter $V_x = V_{in}$ when the transistor is ON and $V_x=V_o$ when the transistor is OFF. For zero net current change over a period the average voltage across the inductor is zero



$$Vin\,t_{ON} + Vo\,t_{OFF} = 0$$

which gives the voltage ratio

$$\frac{Vo}{Vin} = -\frac{D}{(1-D)}$$

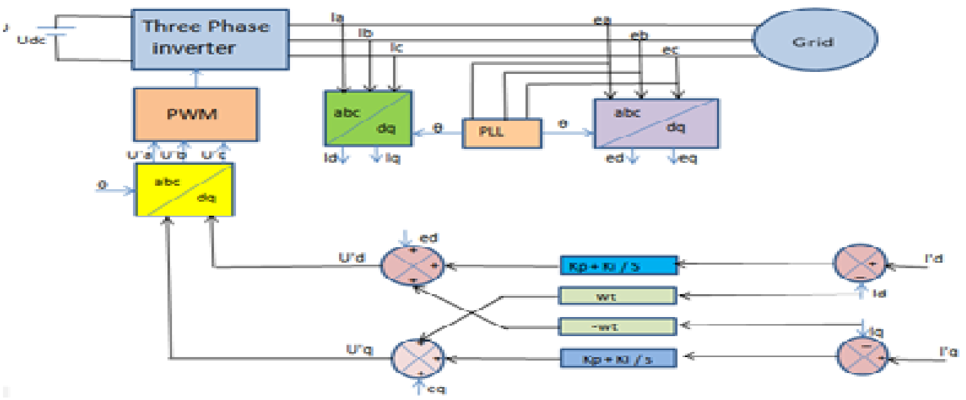
and the corresponding current

$$\frac{Io}{Iin} = -\frac{(1-D)}{D}$$

Since the duty ratio "D" is between 0 and 1 the output voltage can vary between lower or higher than the input voltage in magnitude. The negative sign indicates a reversal of sense of the output voltage.

III. CONTROL METHODOLOGY

The control system has to generate pulse for the park transformation method. The first conversion take place is conversion of Iabc in to Idq0 and then Vdq0. This is the standard conversion of three phase to two phase by reference frame theory and similarly we also have a reference source. error signal are fed to pwm pulse generator for gating pulse for inverter.



Park transformation is used to convert a three phase reference frame to a two phase reference frame which is rotating at synchronous speed.by using below equations the ABC/DQ conversion can be perform.

Vd = 2/3(Va*sinwt + Vb*sin (wt-2pi/3) + Vc*sin (wt+2pi/3))
Vq=2/3(Va*coswt + Vb*cos (wt-2pi/3) + Vc*cos (wt+2pi/3))
V0=2/3(Va + Vb + Vc)

IV. SIMULATION AND RESULTS

Figure 1.Pv array with buck boost converter

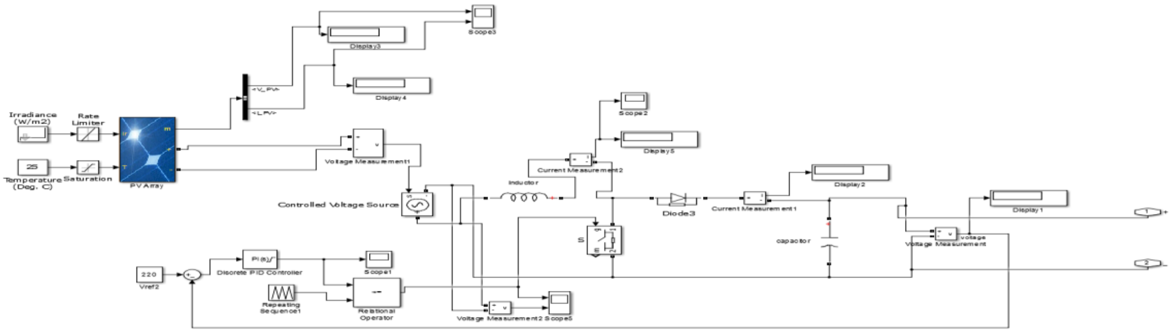


Figure 2.Control system

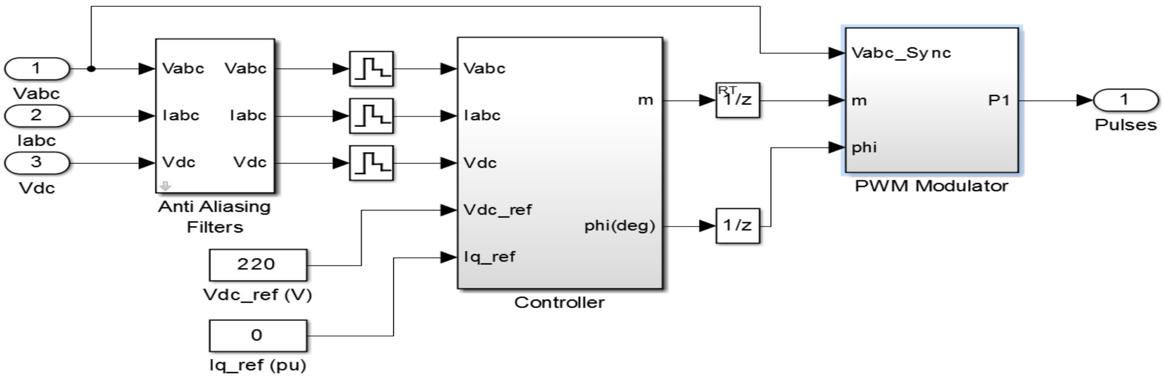


Figure 3.Controller

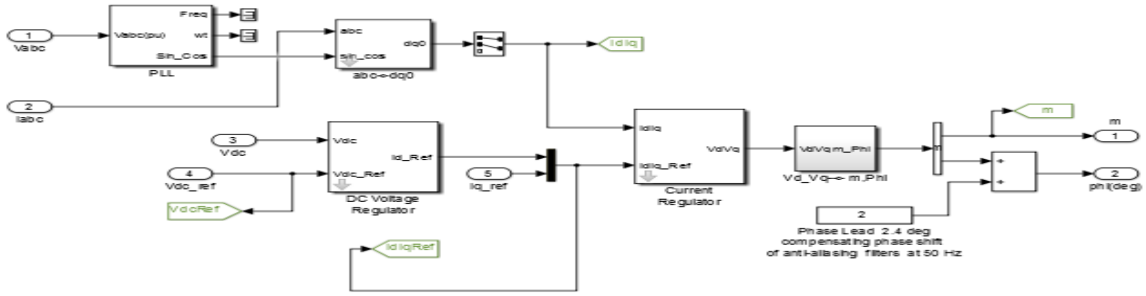


Figure 4. Pwm modulator

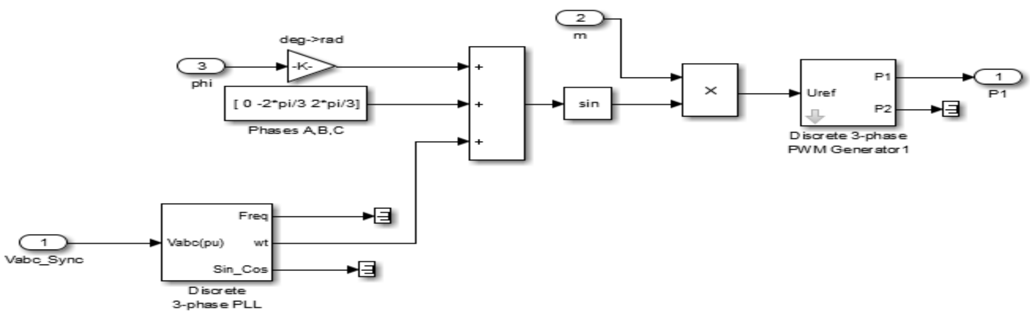


Figure5. Pv system connected to grid

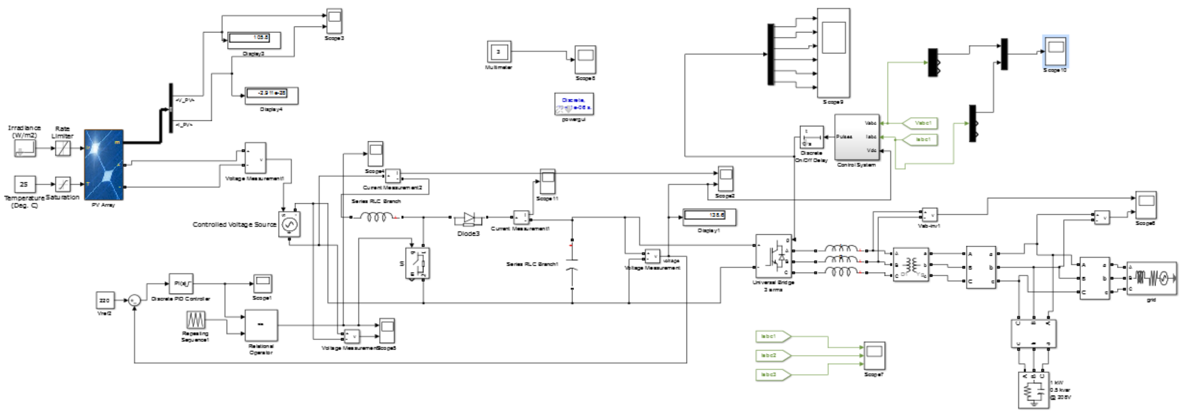


Figure 6.Statcom

statcom are connected grid system in parallel remove the harmonic and using purpose for reactive power compensation

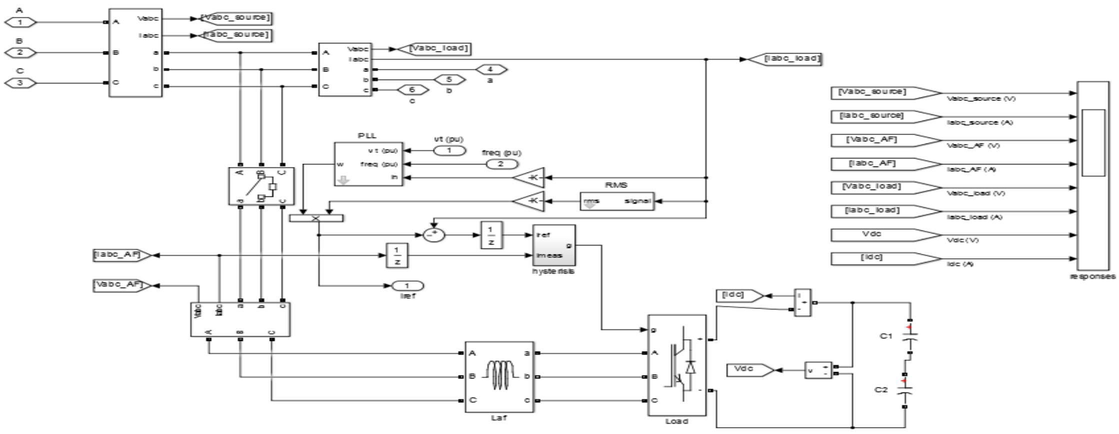


Figure 7.PV output voltage and current

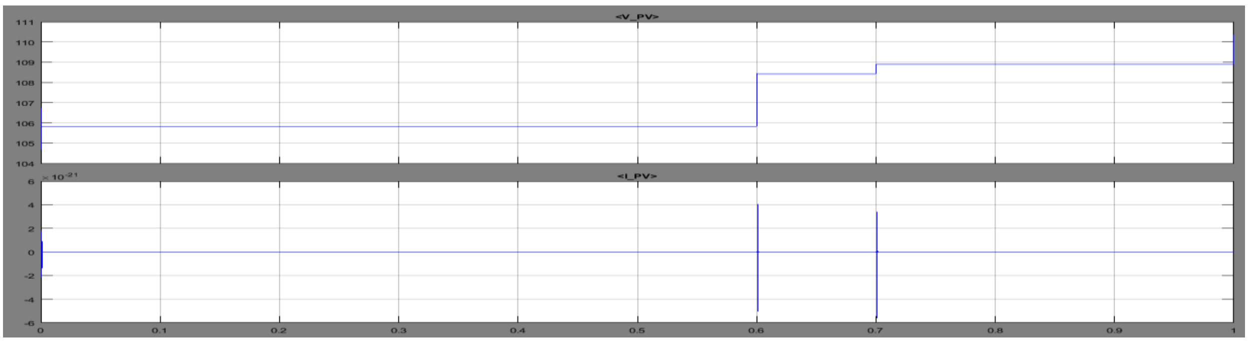


Figure 8.Buck boost converter output voltage

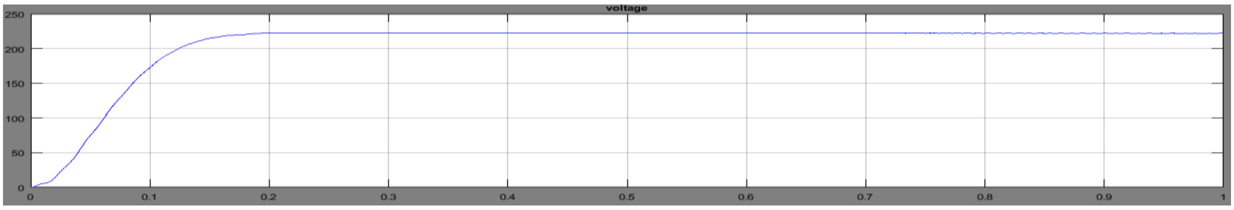


Figure 9.Inverter switching

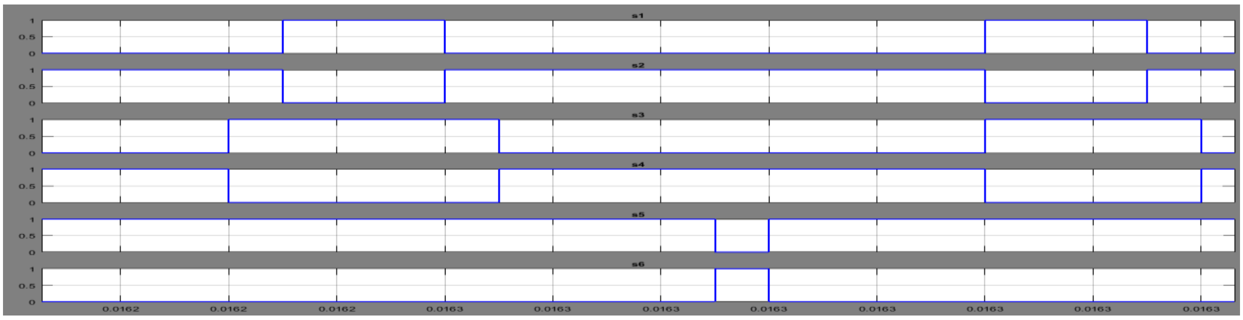


Figure 10.Grid current

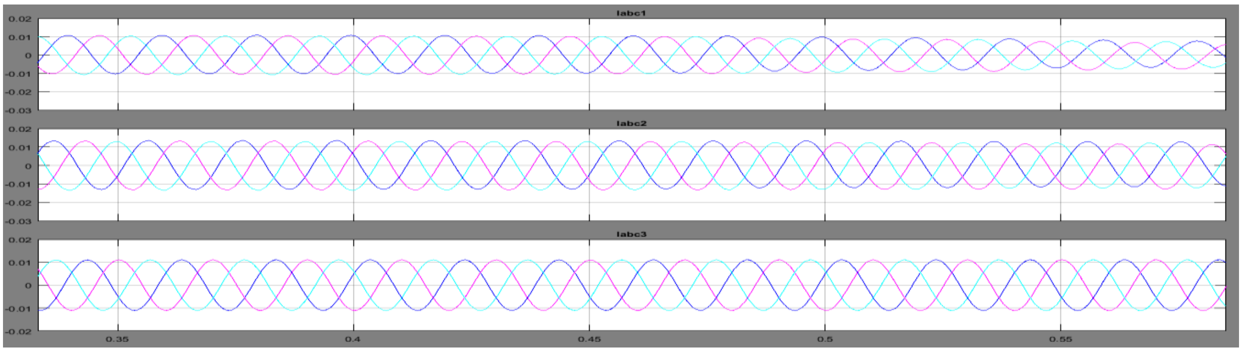


Figure 11.Inverter output voltage

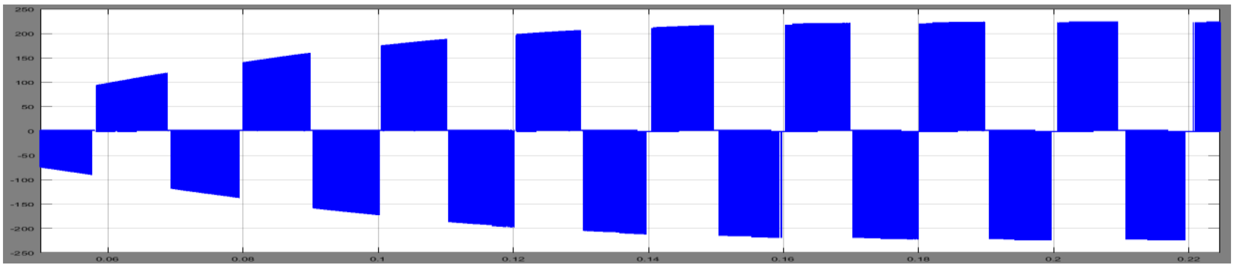


Figure 12.Voltage and current phase angle

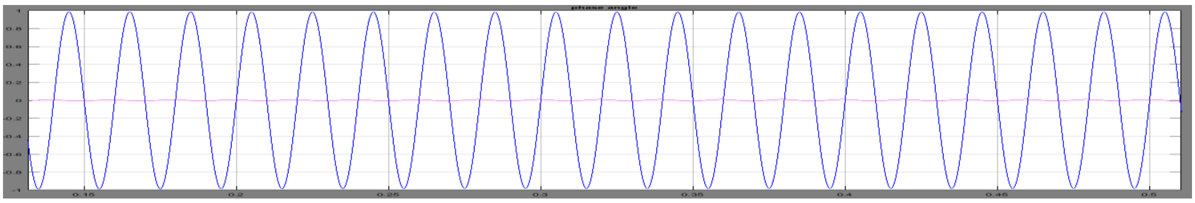
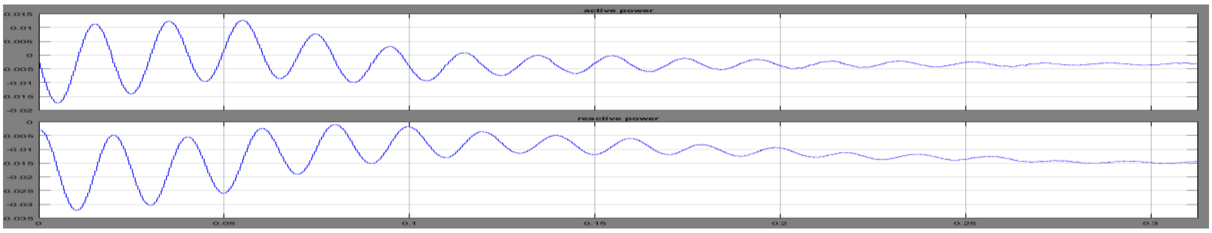


Figure 13. **Active and reactive power**



CONCLUSION

This paper has presented in a reactive power compensation the modelling and the control strategy using dq0 transformation of a three-phase PWM inverter to be employed in a grid-connected photovoltaic generation system. The main focus of this work is to a design of buck boost converter a that would provide solar generation and works as an STATCOM compensating unbalances of power and the reactive power generated by other loads connected to the system.

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