A PV Based Thirteen Level Inverter For Microgrid

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***ABSTRACT*- MicroGrid connected Photovoltaic (PV) system uses to have converters Circuits followed by two levels: A DC/DC boosters and PWM Inverter.[1] This combination of converters leads to decrement of Quality and efficiency of electric power. This Paper Propose a PV based thirteen- level inverter for MicroGrid connected Photovoltaic (PV) system with A novel pulse width-modulated (PWM) control scheme. The fast variations of solar radiation can be compensated MPPT (Maximum power point tracing) controller.[2] The inverter offers less total harmonic distortion and good power factor this paper presents a PV based thirteen- level inverter for MicroGrid. As the number of output levels increases, the harmonic content can be reduced. The inverter adopts a full-bridge configuration with an auxiliary circuit. PV arrays are connected to the inverter via a dc–dc boost converter and a MPPT. The proposed system offers improved performance over five level inverters and is verified through simulation, these results indicate that the THD of the thirteen- level inverter is much lesser than that of the conventional five- level never[4].**

***Keywords:* microgrid,inverter, multilevel inverter, PV, harmonics, switching , pwm , Power quality, Simulation, Pi control.**

I. INTRODUCTION

Microgrid connected photovoltaic (PV) converters represent the most widespread solution for residential RES(renewable energy source) generation. This design of PV based inverters feature a microgrid frequency transformer, which is a typically heavy and costly component complex in maintenance for overcoming this problem a transformerlessinverter is used. in order to reduce costs and weight and improve efficiency. [4], [5]. The inverter offers less total harmonic distortion and good power factor This paper presents a PV based 13- level inverter for MicroGrid. As the number of output levels increases, the harmonic content can be reduced. Multilevel converters have been study for years, but only in recent times have the results of such investigate found their way to saleable PV converters. Since they can produce the output voltages using more levels, multilevel converters outperform conventional two- and three-level converters in terms of harmonic distortion. Moreover, multilevel converters subdivide the input voltage among several power devices [6]–[10].The three types of inverters they are

- Flying capacitor multilevel inverter
- Cascaded h-bridges inverter
- Diode-clamped multilevel inverter

In this we Are used the cascaded bridge inverter

In a microgrid dc power from photovoltaic panels has been converted into ac using dc/dc boosters, MPPT (maximum power point tracker). In PV applications, the PV field dc voltage is constantly changing due to variations of solar radiation and to the MPPT algorithm, but the output voltage has to be controlled regardless of the voltage ratio. and dc/ac multilevel inverter. Due to stationary devices in converter outcome are harmonics injection and lower power factor to electric power system . The load equipments of the modern generation are more sensitive. Due to harmonics can initiate production loss, economic loss and environmental effect. In this paper, we are discussing the dc/ac multilevel inverter based on the PI control to increase the performance of PWM inverter. To minimize the harmonics in the microgrid the PVBased 13 level inverters is proposed.[3]

II. CONTROLS IN MICROGRID

In the microgrid the main source of energy is Photovoltaic (PV) cell. These sources are produce the dc energy output. The load connected to the grid is ac load. The conversion devices have main responsibility in this microgrid.[3]

a) Conversion control: The Photovoltaic cells and fuel cells are connected to the dc bus through a boost DC/DCconverter in order to generate the maximum power from PV cells and fuel cells.. After boost the dc the load is connectedto the grid. The PWM based inverter is used to convert the dc to ac. To operate or control the boost converter and inverterdifferent gate control are used for accurate output and to minimize the power losses . The major problem with controldevices are harmonic generation[11].

b) Power quality control: The power electronics devices are used for interface the renewable sources to microgrid orinter connected with other sources like renewable and non-renewable generators, storage systems and load in microgrid.The microgrid is different from the main grid, where the large and sudden changes in the load may results in voltage transient of large magnitudes in ac bus. The non-linear loads and switching power converters are decreasing the power quality in microgrid [12]. To overcome the power quality problem in distribution the 13 level inverter with PI controller is proposed.

III INVERTER CONTROL'S

PID controllers use a 3 basic behavior types of modes:

P-proportional, I- integral and D- derivative. While Proportional and integrative modes are also used as single control modes a derivative mode is rarely used on it's own in control systems. Such combinations such as PI and PID controller are very often in practical systems[13]

(A) Proportional (P) Controller

A P controller system is a type of linear feedback control system. The P controller system is more complex than on-off control systems like a bi-metallic domestic thermostat, but simpler than a PID control system used in something like an automobile cruise controlIn general it can be said that P controller cannot stabilize higher order processes.

(B) Proportional Integral (PI) Controller

At present, the PI controller is most widely adopted in industrial application due to its simple structure, easy to design and low cost. Despite these advantages, the PI controller fails when the controlled object is highly nonlinear and uncertain. PI controller will eliminate forced oscillations and steady state error resulting in operation of on-off controller and P controller respectively. However, introducing integral mode has a negative effect on speed of the response and overall stability of the system. Thus, PI controller will not increase the speed of response. It can be expected since PI controller does not have means to predict what will happen with the error in near future. This problem can be solved by introducing derivative mode which has ability to predict what will happen with the error in near future and thus to decrease a reaction time of the controller. PI controllers are very often used in industry, especially when speed of the response is not an issue.

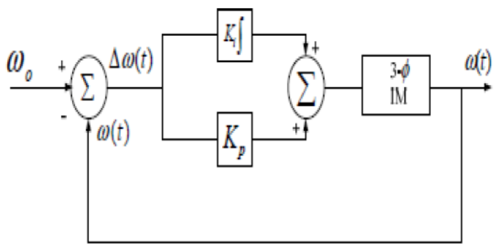

Fig 1 PI controller[13]

1. Fast response of the system is not required

2. Large disturbances and noise are present during operation of the process

3. There is only one energy storage in process (capacitive or inductive)

4. There are large transport delays in the system.

Therefore, we would like to keep the advantages of the PI controller. This leads to propose a PI controller shown in Fig. 6. This controller uses of the proportional term while the integral term is kept, unchanged.

(c) Proportional Integral Derivative (PID) Controller.

Many industrial controllers employ a proportional, integral plus differential PID regulator arrangement that can be tailored to optimize a particular control system. PID controller is most commonly used algorithm for controller design and it is most widely used controller in industry. The controllers used in industry are either PID controller or its improved version. The basic types of PID controller are parallel controller, serial controller, and mixed controller. The PID controller algorithm utilized for is design velocity algorithm, it is also called incremental algorithm. In the industry, PID controllers are the most common control methodology to use in real applications.[13]

PID controller has all the necessary dynamics: fast reaction on change of the controller input (D mode), increase in control signal to lead error towards zero (I mode) and suitable action inside control error area to eliminate oscillations (P mode). Derivative mode improves stability of the system and enables increase in gain K and decrease in integral time constant Ti, which increases speed of the controller response.PID controllers are the most often used controllers in the process industry. The majority of control systems in the world are operated PID controllers. It has been reported that 98% of the control loops in the pulp and paper industries are controlled by single-input single output PI controllers and that in process control applications, more than 95% of the controllers are of the PID type controller. PID controller combines the advantage of proportional, derivative and integral control action.[13]

IV ANALYSIS OF 13-LEVEL INVERTER FOR PV GRID

13 level simulink model

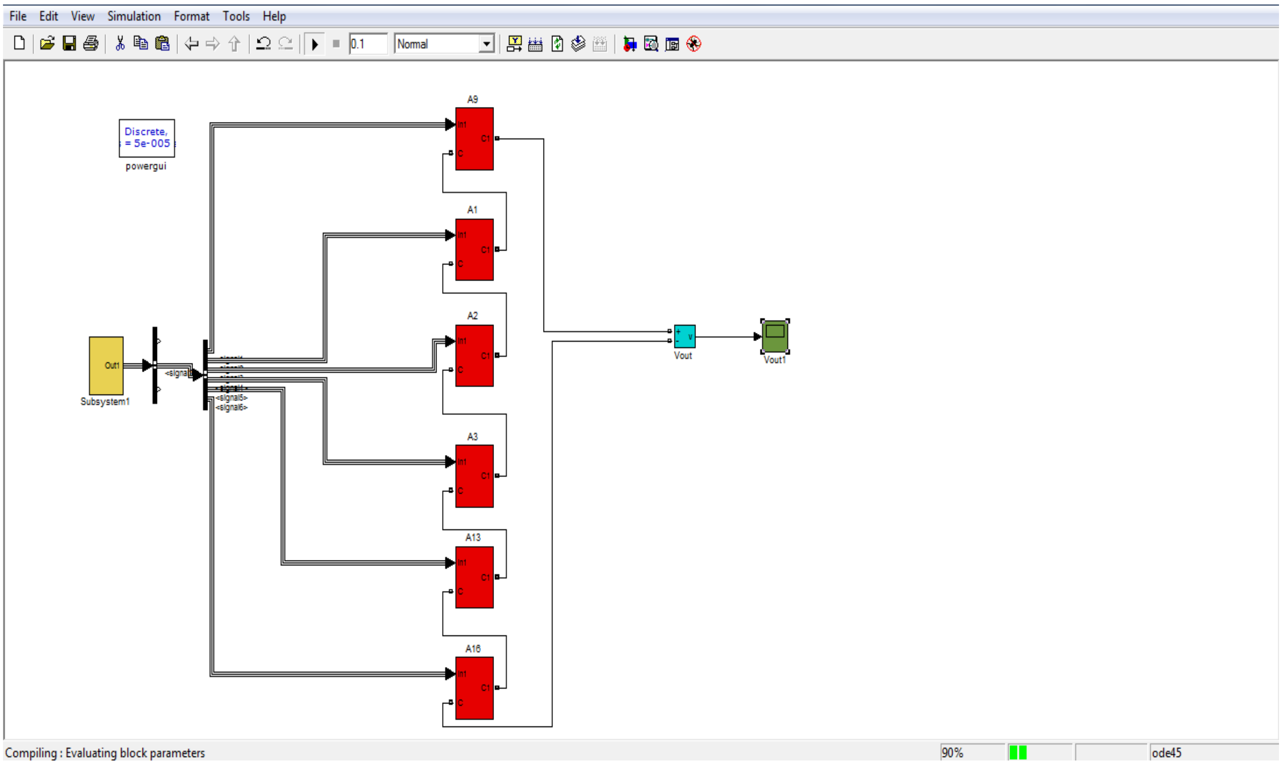

Fig 2 circuit diagram

V RESULTS

VOLTAGE

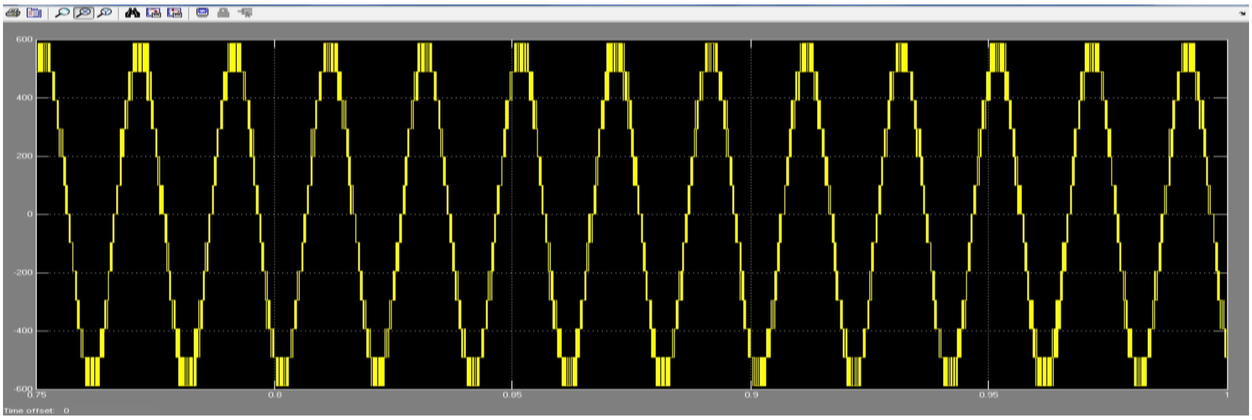

Fig 3 output voltage waveform

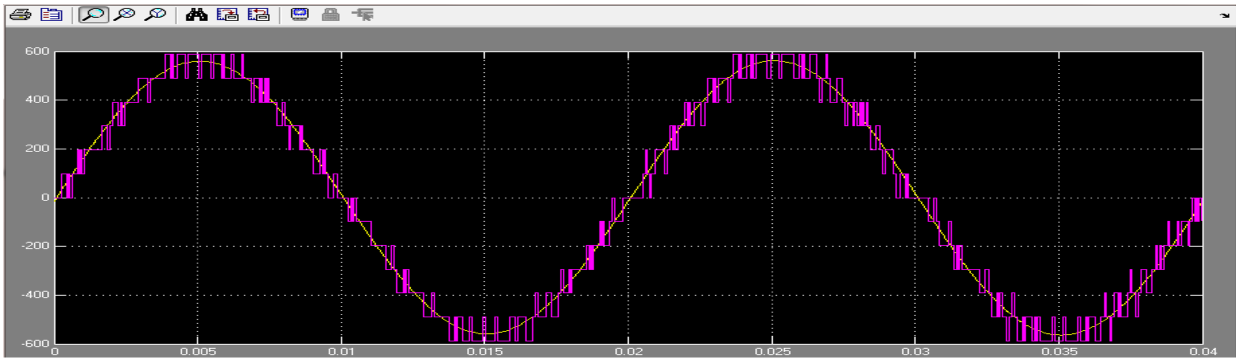

Fig 4 output current waveform

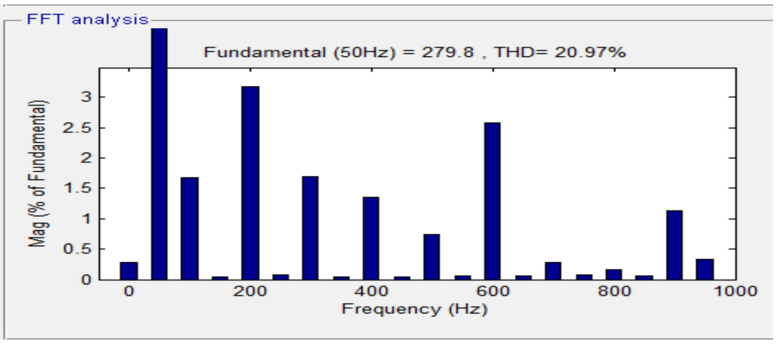

Fig 5 FFT of voltage 7 level

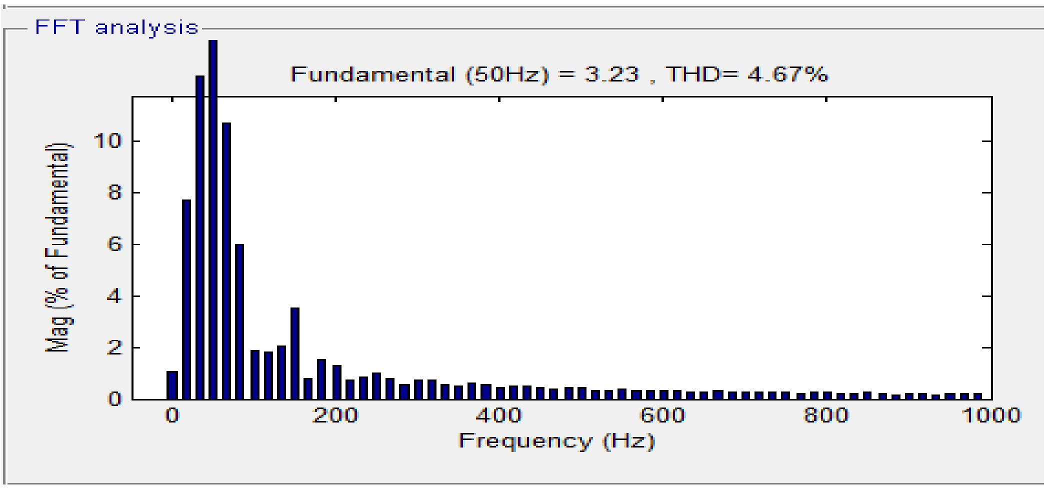

Fig 6 FFT for 13 level

VI CONCLUSION

The paper proposed a PV based 13 Level inverter for microgrid. Which has transformer less based on a CFB (cascaded full bridge) A suitable PWM strategy was developed in order to improve efficiency (most power devices commutate at low frequency). The proposed PWM strategy can regulate the output voltages. Extensive simulations and experiments confirm the results of the PV based inverter and the good

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