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Power Stability in Distribution Systems Employing Renewable Energy Source using Multi Level Inverter

[1]Venkatesan, [2]S.Jerril Gilda

[1]*Pursuing M.E(Powersystems), Dept of EEE, Sri Muthukumaran Insttitute of Technology, Chikkarayapuram,Chennai,TamilNadu, India.*

[2]*Assistant ProfessorDept.of EEE, SriMuthukumaran Insttitute of Technology Chikkarayapuram,Chennai,TamilNadu, India*

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ABSTRACT:
Developments in renewable energy sources such as solar, wind power systems lead to an increase in voltage quality issues such as voltage sags, voltage surges, harmonics, transients, etc. These Renewable Energy power producers are mostly uncorrelated with consumer demand on a time scale due to its high intermittency. Therefore, it leads to one of the main causes of destabilization of the energy system. This paper analyzes the power stability problems due to wind and solar energy power production and discusses various voltage control methods to mitigate the related problems. In this paper it is briefly discussed a real-time regulator system that has a converter, Multi level inverter and current regulator. This system will increase the reliability of the network and ensure the uninterrupted availability of energy for consumers with good voltage and quality of electricity. It will also promote the use of renewable energy and reduce significant environmental damage caused by conventional energy sources.

I. INTRODUCTION:

Solar power production is increasing and the instability of power production happened due to sudden increase and decrease of sun power due to sudden changes in weather. In case of WPP also having same problem in power production. In this Case we consider only the solar and the wind power source and find out the problems arise in the system through Simulink.

The following power quality issues may arise due to the above complications.

Mains frequency fluctuation is defined as the deviation of the basic frequency of the energy system from its nominal value, i.e. 50 Hz. These changes can lead to device failure and increase some electrical and mechanical losses. It may shorten the life of the device connected to the system. It creates an unstable state for the network it is connected to. This can lead to network instability and power outages.

Harmonics are sinusoidal voltages or currents with frequencies that are integer multiples of the frequency at which the power system is designed to operate. Harmonic distortion levels are described by the full harmonic spectrum with the magnitudes and phase angles of each individual hormonal component. It is also common to use a single quantity of total harmonic distortion as a measure of the rms value of the harmonic distortion

II. SYSTEM DESCRIPTION

The system described here having solar and wind energy sources in power production zone and the grid side will face distortion due to the sources. We do exercise on the system with inverter circuit and Multi level inverter circuitwith feed back control and independent control.

Comparison between them done by THD . The whole exercise done by Simulink simulation and output wave form analyzed. Solar system having a PV panel and MPPT controller and it is connected to a DC bus.

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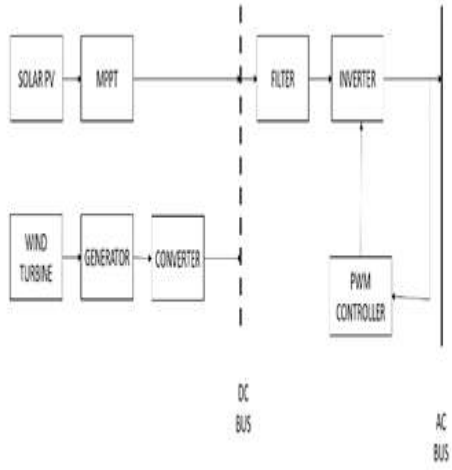

Fig 1 System Block Diagram

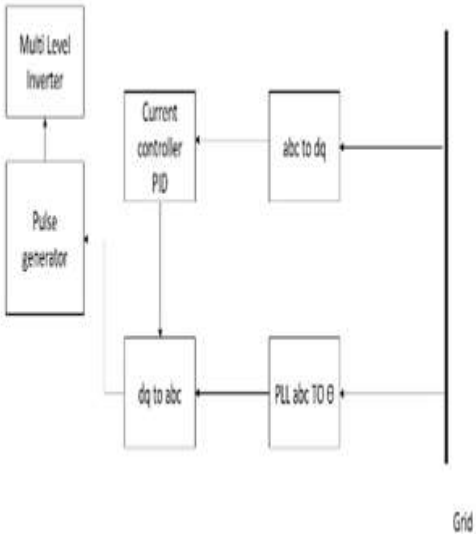

Fig 2 Multi level inverter control

Wind power plant having wind turbine and PMSG setup and it is connected to a DC bus through converter and a filter. The DC bus further connected to a inverter circuit. The inverter output is connected to the grid through transformer. The output of transformer taken as feedback and using PLL and PID current controller the inverter switching controlled.

III. WORKING PRINCIPLE

Solar panels have a nonlinear voltage-current characteristic, with a distinct maximum power, which is subject to on the environmental factors, such as temperature and irradiation. In order to continuously harvest maximum power from the solar panels, they have to operate at their MPP despite the inevitable changes in the environment. This is why the controllers of all solar power electronic converters employ some method for maximum power point tracking (MPPT).

The concept of multilevel Inverter (MLI) is kind of modification of two-level inverter. In multilevel inverters we don't deal with the two-level voltages instead in order to create a smoother stepped output waveform, more than two voltage levels are combined together. Smoothness of the waveform is directly proportional to the voltage levels, as we increase the voltage level, the waveform becomes more smoother but the complexity will be increased.

There are two kinds of controls taken into account. One is feed back control and another one is standard split PWM output control. Both are designed in Simulink and output THD taken into account. The THD diagram is shown below.

PLL and current regulator used to stabilize active and reactive power by zeroing out voltage fluctuations.The PLL system is a feedback system with a PI controller that monitors the phase angle of the line voltage and controls the active and reactive power. The three phases of the mains voltage applied to the output of the PLL are the phase angle of one of the three phases. The purpose of the forward frequency is to have a PI-controller control for the output signal going to zero. The output of the current controller with dq component and the output of the current controller and PLL are converted to the ABC component and fed to the gate pulse generator for the GSC. Active and reactive power controlled by the converter and voltage change controlled by this action.

IV. OUTPUT AND DISCUSSIONS

The follwoing figures showing the outpits of harmonics distortion of two vaiuis controls. One is with feed back and PLL and PID congtroller and another one is staandard spilt PWM output controller. Here we are using 3 level diode clamped multi level inverter which is repleced with two level inverter. The multi level inverter tried with two condtions as mentioned above.

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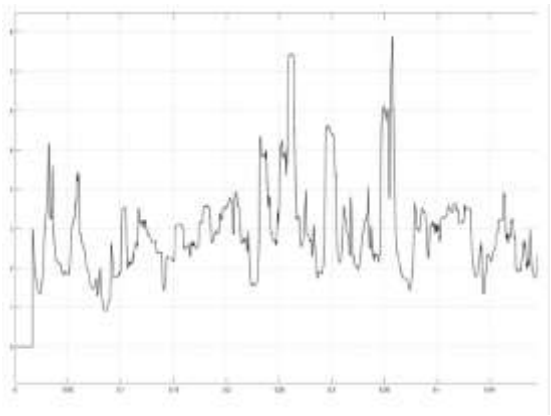

Fig 3 THD without Feed back control

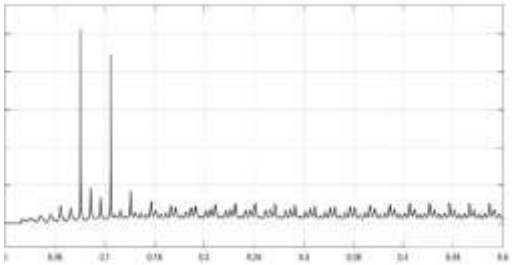

Fig 4 THD with Feed Back control

V. CONCLUSTION

It is shown that THD is reduced by introducing multi-level inverter by feedback control by PLL and PID with PWM technique.

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