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Pv Generation And Power Transmission Analysis Using Power Flow Controllers

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Abstract- Energy security is one of the most crucial factor in the development of any nation. Inter-Connections among different power system networks are made to lower the overall price of power generation as well as enhance the reliability and the security of electric power supply. Different types of interconnection technologies are employed, such as AC interconnections, DC interconnections, synchronous interconnections, and asynchronous interconnections. It is necessary to control the power flow between the interconnected electric power networks. The power flow controllers are used to (i) enhance the operational flexibility and controllability of the electric power system networks, (ii) improve the system stability and (iii) accomplish better utilization of existing power transmission systems. These controllers can be built using power electronic devices, electromechanical devices or the hybrid of these devices. In this paper, control techniques for power system networks are discussed. It includes both centralized and decentralized control techniques for power system networks.

Keywords- Photovoltaic (PV), DC/DC converter, high voltage direct current (HVDC), input parallel output series (IPOS), high voltage; large capacity, high step-up ratio.

I. INTRODUCTION

The Photovoltaic (PV) system has become very popular in renewable energy market. This popularity is mainly due to its wide usage in all the energy markets like residential, commercial and industrial sectors. Even though so many solar thermal methods are developed to tap the energy from the sun, the PV system is considered as a most effective one because of its high efficiency, small size, low cost and light weight. Mostly the PV system is designed either by standalone or by grid connected module. Later it is widely used in the market as it feeds energy in to the grid. Generally, PV array, inverter and grid filters are used in the grid connected PV system. PV modules are the structural basic units of the PV array. They exhibit capacitance with ground called parasitic capacitance. This parasitic capacitance increases if there is a large conducting surface and powerful electric field in the PV arrays. Widely, transformer inverter sections. Grid tied PV inverters are categorized in to four types central inverter, string inverter, Module integrated inverter and multi-string inverter. In transformer inverter topology, the use of the Low Frequency Transformer (LFT) provides better galvanic isolation between the photovoltaic modules and the grid. But, they reduce the overall efficiency by 2% and also bulk in size. The problem of bulk size is resolved by using High Frequency Transformer (HFT). But, it only reduces the size of the system. So, the overall efficiency of the system is further reduced because it needs additional power frequency conversion stages.

II. CHALLENGES IN THE DESIGN OF GRID CONNECTED LESS PHOTOVOLTAIC INVERTER

(i) Normally the PV inverters inject harmonics in to the grid connected system which reduce the quality of power supply to the consumers.

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(ii) Voltage fluctuation which is usually occurred in the system while connecting and disconnecting the PV power system with the grid

(iii) It is highly complex task to assess the short circuit, fault current by using traditional relays used in the power system.

(iv) The virtual parasitic capacitance existing between PV panels to the ground creates the path for the leakage current - this is considered as a major issue in the grid connected PV system.

(v) The PV power system injects DC offset current in to the grid.

(vi) Islanding effect is created by the PV system in case of grid failure

Research Motivation

The economic progress of any country majorly relies on the energy that can be regarded as the key input for the development. The rapid growth of industries, vehicles and domestic users led to the consumption of the energy on a large scale. The fossil fuels are depleting day by day and the pollution caused to the atmosphere, an increase of the global temperature are considered to be the dominant challenges to protect the environment.

III. CONTRIBUTIONS OF THIS DISSERTATION

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The contributions of this work are summarized as follows:

1. The conclusion drawn from the simulation curves of three algorithms, is that for better efficiency the fuzzy logic and increment conductance are better than P&O algorithm. From the analysis of maximum power (Pmax) and maximum voltage (Vmp) the fuzzy logic and increment conductance algorithm can work at partly cloudy whether while P&O algorithm can exhibit erratic behavior in case of rapidly changing atmosphere.
2. The buck is connected with P&O give a value of 26.8 V therefore buck that connected with incremental conductance give value of 17.87V. In incremental conductance algorithm the output voltage and current is not change between input and output value. The perturb and observe algorithm give a difference for input and output value. The output value behave as buck converter behave. The voltage will drop from 26.8V to 16.8V and finally the voltage value is 534mV. It is apparent from this, that incremental conductance algorithm has been worked better with buck converter than perturb & observe algorithm. The incremental conductance algorithm has the stable value from start to end of the simulation.
3. The perturb and observe algorithm shows an unstable condition. During the simulation the current and voltage decrease rapidly and lastly came to same value at the initial stage. It is evident from the simulation result that algorithm connected with boost converter has given a stable output by the incremental conductance algorithm. Perturb & observe algorithm has been achieved maximum output value at 37.99 V that better than incremental conductance algorithm.
4. The comparison between perturb & observe algorithm and incremental conductance algorithm. From the simulation the input voltage from PV panel to the algorithm and the converter give almost the same value. The input current for this circuit give big value of current, 2800 A and this value is same for both algorithms. Further, in this condition incremental conductance algorithm has given the negative value of current and voltage. This is cause the positive power output.
5. In three-phase five-level DCMI, the outcomes indicate that FLC MPPT method is paramount MPPT method in terms of THD as compared to P&O and INC MPPT methods since THD value is 1.33%. This verifies that MPPT techniques can decrease the THD value of multi-level inverters, which is essential condition for grid-connected PV systems.
6. In single-phase five-level cascaded H-bridge multilevel inverter, the outcomes show that FLC MPPT method is best MPPT method in terms of THD as compared to P&O and INC MPPT methods since THD value is 1.01%. This validates that MPPT techniques can decrease the THD value of multi-level inverters, which is essential condition for grid-connected PV systems.
7. In three-phase five-level cascaded H-bridge multilevel inverter, the results point out that FLC MPPT method is superior MPPT method in terms of THD as compared to P&O and INC MPPT methods since THD value is 0.25%. This proves that MPPT techniques can reduce the THD value of multi-level inverters, which is necessary condition for grid-connected PV systems.
8. The proposed control scheme highlights several advantages such as the generation of high-quality outputs, the capacity to operate at a lower switching frequency by five level converter. 9. It is

suggested the SVPWM technique is better than SPWM in term of THD.

10. The proposed fuzzy MPPT does not require an intermediate stage of dc/dc chopper control, as the optimum dc voltage is set by the inverter itself.
11. For nonlinear systems, the FLC can provide more efficient than the conventional controller. The control of active and reactive power is done with the help of PI controller. The simulation of control scheme is done digitally under linear and nonlinear loads.
12. The results confidently promise to use the inverter in high voltage and also in high power applications such as PV generation system with grid connected. The proposed of five level inverter solves EMI, harmonics and high frequency switching problems.
13. Developed an individual MPPT control scheme in one central controller for both single-phase and three-phase cascaded H-bridge multilevel PV inverters to realize better utilization of PV modules and increase the overall efficiency of the PV system.
14. For the three-phase cascaded H-bridge multilevel PV inverter, balanced the threephase grid current injection during partial shading or module degradation conditions by applying a modulation compensation scheme. There is very little chance with the proposed modulation compensation scheme that over modulation will happen. The limitation of the scheme is also pointed out.

IV. CHARGE CONTROLLER

Charge controllers are used in PV systems that use batteries, which are stand-alone systems in most cases. As we have seen before, it is very important to charge and discharge batteries at the right voltage and current levels in order to ensure a long battery lifetime. A battery is an electrochemical device that requires a small overpotential to be charged. However, batteries have strict voltage limits, which are necessary for their optimal functioning. Further, the amount of current sent to the battery by the PV array and the current flowing through the battery while being discharged have to be within well defined limits for proper functioning of the battery. We have seen before that lead acid batteries suffer from overcharge and overdischarge. On the other hand, the PV array responds dynamically to ambient conditions like irradiance, temperature and other factors like shading. Thus, directly coupling the battery to the PV array and the loads is detrimental to the battery lifetime. Therefore a device is needed that controls the currents flowing between the battery, the PV array and the load and that ensures that the electrical parameters present at the battery are kept within the specifications given by the battery manufacturer. These tasks are done by a charge controller that now a days has several different functionalities, which also depend on the manufacturer. We will discuss the most important functionalities. Charge Controllers Functioning: When the sun is shining at peak hours during summer, the generated PV power excesses the load. The excess energy is sent to the battery. When the battery is fully charged, and the PV array is still connected to the battery, the battery might overcharge, which can cause several problems like gas formation, capacity loss or over- heating.

Here, the charge controller plays a vital role by decoupling the PV array from the battery. Similarly, during severe winter days at low irradiance, the load exceeds the power generated by the PV array, such that the battery is heavily discharged. Overdischarging the battery has a detrimental effect on the cycle lifetime, as discussed above. The charge controller prevents the battery from being over-discharged by disconnecting the battery from the load. For optimal performance, the battery voltage has to be within specified limits. The charge controller can help in maintaining an allowed voltage range in order to ensure a healthy operation. Further, the PV array will have its Vmpp at different levels, based on the temperature and irradiance conditions. Hence, the charge controller needs to perform appropriate voltage regulation to ensure the battery operates in the specified voltage range, while the PV array is operating at the MPP. Modern charge controllers often have an MPP tracker integrated.

V. RESULT AND SIMULATION

One of the most important advantages of solar hybrid systems is a complementary factor for PV panels whose output characteristics change depending on the weather conditions. With the energy storage unit in the system the ripple effects are prevented in the DC bus. Thanks to the battery group, quality energy is provided and the continuity of energy is maintained. Solar hybrid systems occupy the grid as little as possible regarding energy use. In

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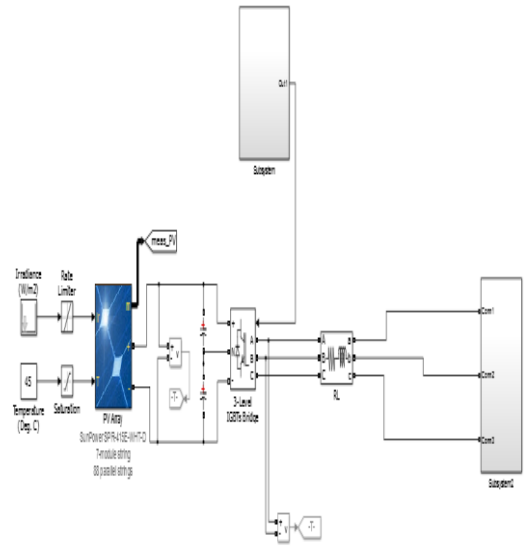
contrast, solar hybrid systems support the grid structure.



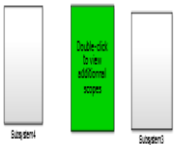


Figure 1 Model.

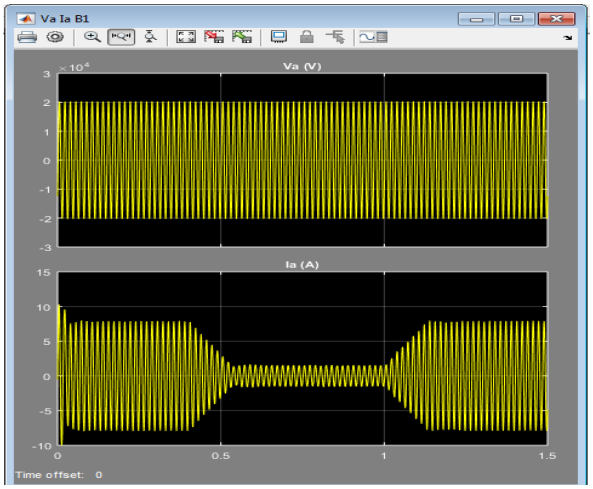


Figure 2 Output waveform.

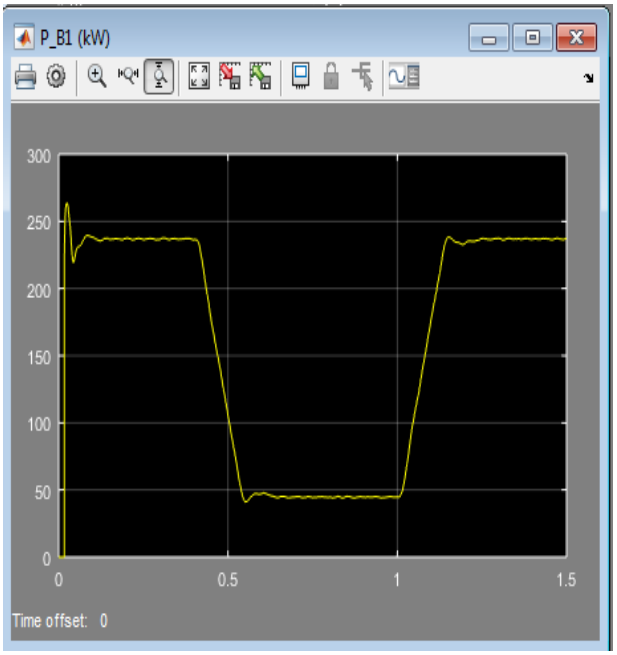


Figure 3 Power flow.

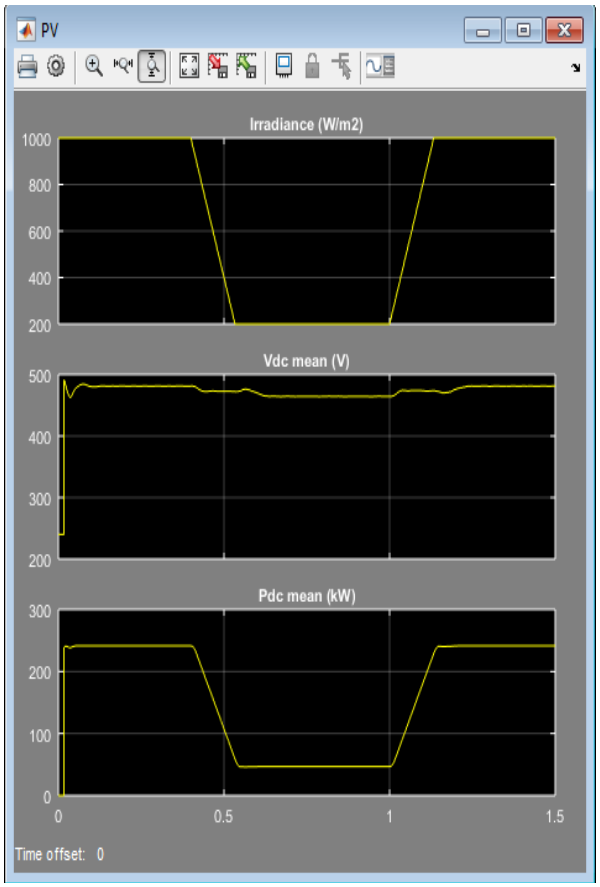


Figure 4 Inputs.

Summary

PV-systems offer a wide range of possibilities and configurations for the use of power electronic converters. An overview technologies and transformer less topologies is given and the technology is presented as promising for the future. In addition some problems from the application side are given. Future work will be to compare the transformer less topologies with special respect to the induced ground-leakage currents by simulation and measurements on an experimental setup. Experimental measurements are important, because parasitic effects, which are difficult to understand only by simulation, play a role for the paths of the leakage currents at higher frequencies.

VI. PV GENERATING SYSTEMS SCENARIO

Sun is a huge source of energy from which a very negligible portion is used by the earth's eco-system and atmospheric condition. Utilizing this solar energy for harvesting electrical energy can be a reliable low carbon emission alternative. In figure 3.2 the comparison of different energy sources life cycle emission is given [17]. It is observed from the graph that coal and natural gases are the highest CO2 emitting sources and solar energy is having quite fewer emissions compared to the other two. development in India happened due to various major factors during the end of 20th century. Those are summarized into three categories and are given in figure 3.3. PV technology has improved in the last few decades that the efficiency which was about 8%-9% during 1980s is now nearly 20% in a few years. The improvement in PV cell material and advanced technologies used for better performance has gradually decreased the PV peak watt-hour cost and increased its reliability.

In April 1954 scientists Gerald L. Pearson, Daryl M. Chapin and Calvin S. Fuller discovered PV cell that directly converts solar energy into electrical energy at Bell Telephone Laboratories and the PV cells were having efficiency nearly 6%. In the year 1956 the solar modules were made commercially available but the cost was very high. In the late 1960s the PV system was used for powering satellites with improved efficiency of 14% [18]. Various advancements in solar energy production and variety of policies carried out by the Indian government made India is emerging as a leading country in green power utilization worldwide. The country's economy can also experience great development as electrical energy usage has a huge impact on the Gross Domestic Product (GDP) of the country. As much as the per capita usage of electricity increases the development of the country also enhances.

VII. CONCLUSION

Most of the people are aware about non-renewable energy resources. Solar energy has become increase more popular due to their economic benefits. By on Battery Backup, Solar Energy can even provide Electricity 24x7, even on cloudy days and at night. This also used with inter-grid System with Continuously Power supply. It has more benefits compared to other forms of energy like fossils fuels and petroleum deposits. It is an alternative which is promise and consistent to meet the high energy demand. Research on solar cell and solar energy is promise has a future worldwide.

Future Scope

- This research work can be further extended to propose different topologies for PV interfaced module integrated converters considering converter size and cost factors. Power flow between PV and grid can be further enhanced by reliable and efficient inverter modelling. In this research work, a single diode PV model has been considered by neglecting the effect of parallel connected diode and it is considered for uniform irradiation. In future the focus can be extended towards proper PV modelling by considering all unavoidable practical conditions. This will make the PV panel efficient and reliable even during shading conditions.
- Power electronic interface is a very crucial step in PV energy utilization. Improving the converter and inverter efficiency is a challenging task. Generally, micro-inverters are made for lower wattage applications with having lower efficiency. Novel advancement in MIC topology for higher efficiency can add more benefits for the use of RES.

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