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Review Of 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 and transformer less topologies are used in the 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

- Normally the PV inverters inject harmonics in to the grid connected system which reduce the quality of power supply to the consumers.
- Voltage fluctuation which is usually occurred in the system while connecting and disconnecting the PV power system with the grid
- It is highly complex task to assess the short circuit, fault current by using traditional relays used in the power system.
- 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.
- The PV power system injects DC offset current in to the grid.
- Islanding effect is created by the PV system in case of grid failure

II.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 CONTRIBUTIONS OF THIS DISSERTATION

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. LITERATURE REVIEW

Yeq in Wang, Unified control scheme for a dual-stage grid-connected PV system with mode change: This paper proposes a unified control scheme for a dual-stage grid-connected PV system to achieve both the maximum power point tracking (MPPT) mode and the droop mode of operation with mode change. The DC-bus voltage regulation is achieved through the DC–DC converter control, and different modes of operation and the MPPT function are implemented in the DC–AC converter

control, where three digital switches are designed to achieve seamless mode change. To enhance system stability and flexibility, a droop coefficient self-tuning algorithm is proposed to handle the scenario with insufficient solar irradiation in the droop mode. The effectiveness of the proposed methods is validated through both experimental and simulation studies.

Saurabh Gupta, Soft switched DC-DC converter for hybrid power generation photo voltaic panels using fuzzy logic controller:Maximum Power Point Tracking (MPPT) with a Z source cascaded inverter based on Fuzzy Logic Control (FLC) is proposed in this research for a hybrid photo-voltaic (PV) and wind turbine (WT) system. In the absence of PV or WT power generation, the suggested system offers an uninterrupted power supply to the grid. PV functions as a current source and creates maximum power at maximum power point (MPP), supplying just the deficiency power.

This FLC-integrated technique minimises the complexity of typical PID controllers while also improving overall performance. To reduce switching losses, current, and voltage switching stress, a traditional dc/dc boost converter with soft switching has been introduced. To reduce switching stress, a boost converter with zero voltage switching is used. This research focuses on a Zero Voltage Switching (ZVS) technique that uses fuzzy logic control to meet the PV system's MPPT and output voltage regulation requirements. All these PV and wind hybrid systems, a Z-Source network, and a five-level cascaded inverter are part of the proposed topology. The advantages of a Z-source inverter outweigh the disadvantages of a traditional voltage-source inverter. The required stepped output voltage is achieved by boosting the DC link voltage from the PV system using a shoot through state. The suggested system has been simulated with MATLAB/SIMULINK, and the closed loop control technique has been investigated and verified.

SaeedrezaJadidi, Passive Fault-Tolerant Model Predictive Control of AC/DC PWM Converter in a Hybrid Microgrid: This paper aims at presenting a novel fault-tolerant control (FTC) scheme for an AC/DC pulse-width modulation (PWM) converter operating in a microgrid framework. A group of interconnected loads and distributed renewable energy resources such as wind farm, solar photovoltaic (PV) farm, and a battery energy storage are considered to form a microgrid. The control system for the AC/DC PWM converter aims at tolerating the fault effects due to power-loss malfunctions in the solar system. A passive fault-tolerant control scheme based on model predictive control (MPC) is proposed and the effectiveness of the designed scheme is demonstrated in an advanced microgrid benchmark model implemented in MATLAB/Simulink environment.

V. 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.
V 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.

VI. 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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