OPTIMIZED REACTIVE POWER CONTROL OF MODULE POWER IMBALANCE OF CASCADED INVERTER

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***Abstract*— This project presents the detection of High Impedance Fault (HIF) in solar Photovoltaic (PV) integrated power system using recurrent neural network-based Long Short-Term Memory (LSTM) approach. A learn an IEEE 13-cable system was mode in MATLAB software simulink to In the medium voltage cascaded converter, the power imbalance problem among the converter modules will result in certain converter modules over-modulated. Reactive power control (RPC) scheme is an effective way to balance the cascaded converters. Many efforts, such as reactive power sharing control and apparent power sharing control have been used to solve the over modulation issue. This paper investigates an optimization RPC scheme to solve the over modulation problem by minimizing the total required reactive power. An improved minimum reactive power (IMRP) RPC scheme is presented, the feasible area for the active power imbalance is evaluated and compared with the reactive power sharing control scheme and the apparent power sharing control scheme. Finally, the control scheme is verified on a three-module scaled-down cascaded inverter**

I. INTRODUCTION

Recently, the power system has faced serious problems with the power supply and power quality. The grid-connected photovoltaic (PV) generator is currently more common due to its dependable performance and capacity to produce electricity from renewable energy sources. In order to maximize the amount of energy produced by PV arrays, their DC output voltage is connected to The PV medium-voltage cascaded converters, which eliminate the bulky low-frequency transformer in conventional centralized PV plants, are potential candidates for next generation utility-scale PV plants. In the construction of high-efficiency cascaded photovoltaic systems, two conventional structures are the three-stage structure and the two-stage structure, which are depicted In the three-stage structure is used, the active power imbalance problem can be solved by the parallel connection of the first-stage power converter. Compared with the three stage structure, the two-stage structure is more advantageous on efficiency and cost due to the reduction of power stages.

An important issue in the control system design of two stage converters is active power imbalance. The output power of the PV panels varies with the change of irradiance, temperature, etc. In three-stage converters, the active power imbalance problem is solved by constructing a DC bus to distribute power through power modules. For two-stage converters, the DC bus is unavailable due to the absence of the front-end DC/DC converters. Thus, the active power imbalance is a critical problem for the PV medium-voltage two-stage cascaded converters The PV-APF combination, however, has only just been created. Combining these technologies allows for the simultaneous correction of power factor, current imbalance, and current harmonics as well as the injection of PV-generated energy with low total harmonic distortion (THD).

With the help of this feature, researchers may integrate MATLAB's flexible power systems simulation with Simulink's comprehensive and ready-to-use control systems library, reducing the amount of time needed for modeling. Researchers and developers working

in the subject of power systems can also use MATLAB's interface with ease.

II. MOTIVATION FOR THE WORK

Although the demand for power has continually outpaced the supply, it has recently been more readily available in India. Because of this, unconventional sources are becoming the main draw. The wind energy system and solar photovoltaic system are two of these rapidly expanding non-conventional sources that are widely used.

III. LITERATURE SURVEY

The phrase "Micro-Grid Autonomous Operation During and Following Islanding Process" by M. R. Iravani, P. W. Lehn, and F. Katiraei. The investigation in this work looks at fault occurrences and preplanned switching events that cause a distribution subsystem to become islanded and a micro-grid to develop. There are two distributed generation (DG) units in the micro-grid. A power electronic converter connects the two units, one of which is a typical rotating synchronous machine. The latter unit's interface converter has independent real and reactive power regulation to reduce islanding transients and preserve the micro grid's angle stability and voltage quality..The PSCAD/EMTDC software package is used to conduct the research, which are based on a digital computer simulation technique. The tests demonstrate that even during islanding transients, a suitable control technique for the power electronically interfaced DG unit may guarantee micro-grid stability and preserve voltage quality at designated buses. This report comes to the conclusion that the notion of micro-grid becomes a technically viable option for further research when there is an electronically-interfaced DG unit present.

Francois Giraud and Zyiad M. Salameh's paper "Steady-State Performance of a Grid-Connected Rooftop Hybrid Wind-Photovoltaic Power System" was published. This study examines the efficiency of a household 4-kW grid-connected wind photovoltaic system (WPS) with battery storage that is situated in Lowell, Massachusetts. According to the Utility Company's recommendation, the system was initially built to handle a typical New England (TNE) load demand with a loss of power supply probability (LPSP) of one day per 10 years. The wind is a more dynamic source than solar in this paper's hybrid wind-solar power generation with battery storage;additionally, it supplies energy when there is little or no sunlight. By storing energy from the utility during periods of low demand and retrieving it to the load during times of peak demand, household storage can also help ease the strain on the utility during peak hours, hence lowering the need for pricy generation units.

Joseph M. Guerrero, Juan C. Vasquez, José Matas, Luis Garca de Vicua, and Miguel Castilla, "Hierarchical Control of Droop-Controlled AC and DC Micro grids—A General Approach toward Standardization." Distributed energy-storage systems (DES) and AC and DC micro grids (MGs) are essential components for combining renewable and distributed energy resources. In the most recent years, efforts have been made to standardize these MGs. In order to provide MGs intelligence and flexibility, this study presents hierarchical control that was derived from ISA-95 and electrical dispatching standards. In this study, the harmonic current can be produced by placing an inverter next to the bypass switch."ESSRES finds a workable approach to address this. In contrast, each DG serves a local load in the islanded mode and distributes the common load using power regulation.

M. H. Nehrir, C. Wang, K. Strunz, H. Aki, R. Ramakumar, J. Bing, Z. Miao, and Z. Salameh's paper, "Cooperative Control Strategy of Energy Storage System and Microsources for Stabilizing the Microgrid during Islanded Operation," was published. This study presents and assesses through simulation and experiment

the cooperative control method of microsources and the energy storage system (ESS) during islanded operation. The frequency and voltage are controlled mostly by the ESS. The microgrid management system's secondary control then reduces the ESS's current power output to zero. Results of the tests indicate that the suggested cooperative control technique can control frequency and voltage, and the secondary control action can help to improve the control potential.

IV. EXISTING SYSTEM

A microgrid with many (more than two) DG units must have power management (power sharing), especially when operating autonomously. A microgrid needs quick power management reaction more than a large, linked grid does. Reasons include

• The existence of several small DG units, each with a very diverse power capacity and generation characteristics;

• The absence of a major source of energy generation when operating autonomously; and

• Electronically Interfaced DG (EI-DG) units' quick response times, this, if the proper safeguards aren't in place, could have a negative impact on voltage/angle stability. Real and reactive power references are assigned to the DG units by the micro grid power management.

• Swiftly react to disruptions and transients brought on by modifications in the operation mode of the system,

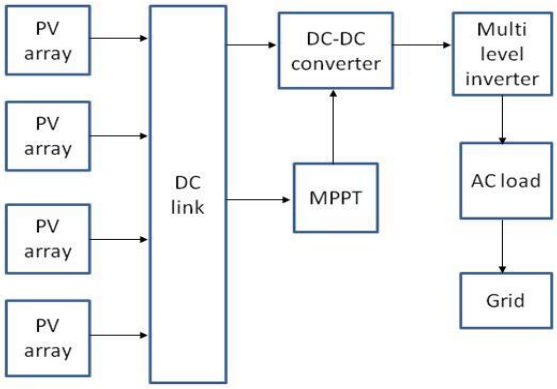
• calculate the DG units' final power generation set-points to restore the system's frequency and balance power;

• offer a way to reconnect the autonomous microgrid to the main grid by resynchronizing them.

V.Proposed System

In existing system dynamic nature improvement of voltage and efficiency proposed to improve power sharing configurations of the distribution network challenges of a micro grid. Effective methods are then performance taking the controller modes.

BLOCK DIAGRAM



Block Diagram Description

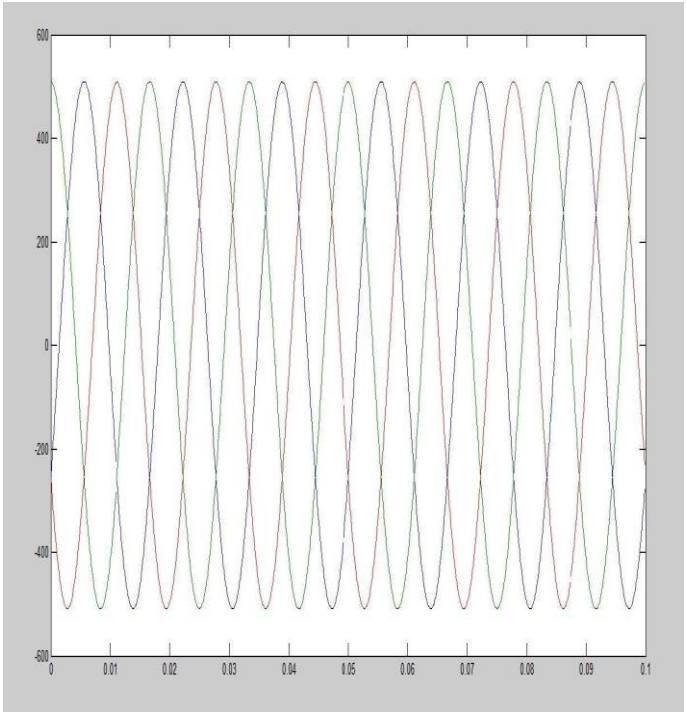
The entire block system comprises of multiple PV array. The PV system is powered by the solar energy which is abundantly available in nature. PV modules, maximum power point tracing systems make the PV energy system.Solar energy harvesting techniques are used to transform the light that strikes the PV cells into electrical energy. To get the most power out of the PV modules, the maximum power point tracking system with Perturb & absorb algorithm is applied. PV output can be fed into a DC-DC converter that can be utilized to increase the power output.

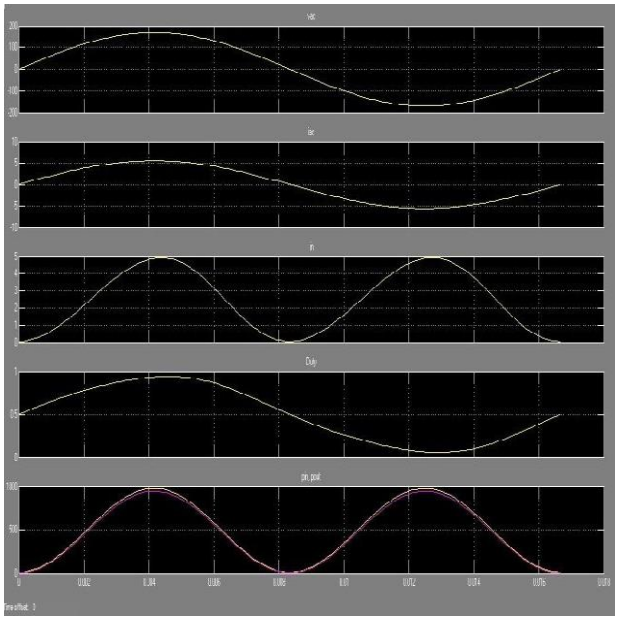
DC-DC converters are electrical circuits or electromechanical devices that change the voltage level of a direct current (DC) source. MPPT power tracking allows for a range of power levels from very low to very high.Fixed dc voltage is converted to variable ac voltage using a multilayer inverter. The dispersed substations on the grid may receive the output as a load.The energy systems are used to charge a battery using bi-directional converter. Bidirectional converter and the battery form the

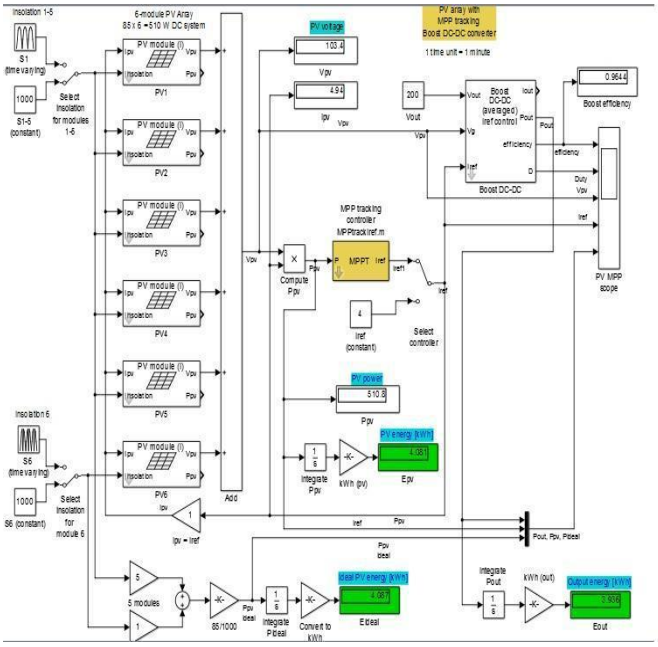
common additional load to the PV energy systems.

The consistency of load needs throughout time can be considerably improved by using multiple PV generation systems that draw electricity from different sources. Multiple PV systems can attain even higher producing capacity. No matter the weather, we can deliver

fluctuation-free output to the load using a stand-alone system. An effective energy may be obtained and supplied to the grid by converting the PV system's energy output to storage energy and ensuring that the PV panel delivers steady power.







V. Conclusion

The effect of reactive power compensation on system operation in grid interactive Fuzzy logic controlled cascaded PV system. The stability and reliability issue caused by unsymmetrical active power was specifically analyzed. Reactive power compel distribution was introduced to mitigate this issue. The output voltage of each module was verified to directly determine the power distribution was illustrated with a wide power change range. An optimized IMRP was proposed considering the MPPT implementation, grid voltage and over modulation. Moreover, the IMRP eligible to be integrated into different types of cascaded PV system. Correspondingly, the control system with MPPT control and optimized RPCA was developed

and validated by the simulation result under different scenarios. The approach was demonstrated to be able to effectively enhance system operation stability and reliability, and improve power quality.

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