Rate of change of PCC voltage harmonic profile Injection-Based Hybrid Active Islanding Detection Technique for PV-VSC-Based

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Abstract- *Optimal selection and sizing of Distributed Energy Resources (DER) is an important research problem for the advancement of distributed power systems. This paper presents detail studies on optimal sizing of DER for integrated micro grids using Evolutionary Strategy (ES). Integrated micro grid is an innovative architecture in distributed power systems, in which several micro grids are interconnected with each other for superior control and management of the distributed power systems. Right coordination among DER in micro grids, and proper harmony among the micro grids and the main distribution grid are critical challenges. Types of DER and capacities of them are needed to optimize such that proposed integrated micro grid provides reliable supply of energy at cheap cost. In this research, the problem is formulated as a nonlinear mixed-integer minimization problem which minimizes capital and annual operational cost of DER subject to a variety of system and unit constraints. Evolutionary strategy was developed for solving the minimization problem. The proposed methodology was used to design integrated micro grids for A Star IEDS (Intelligent Energy Distribution System) project. The design results have shown that the proposed methodology provides excellent convergence and feasible optimum solution.*

Keywords- Photovoltaic systems (PV), voltage source converter (VSC), binary tree (BT), harmonic amplification factor (HAF), BFSMC.

I. INTRODUCTION

INCREASED system reliability, improved power quality, Arrangement of ancillary supply free from right-of-way provision Are some of the few primary reasons that micro grid System with multiple distributed energy resources (DER) is One of the fastest growing market in present energy scenario. With other major grid operational issues, islanding is one of The prior concerns for DER based micro grid applications. Achieving an islanding protection scheme with rapid detection And DER disconnection from local network is drawing Considerable research attention in present literature. These Methods are primarily classified as communication based Methods and distributed generation (DG) residential method ,Which is further sub grouped into passive and active methods. Passive methods are based on multiple points of common coupling (PCC) parameter based decision techniques where there is no considerable impact in power quality. Over/under Voltage protection, over/under frequency protection, rate of Change of frequency and power and harmonic distortion. Are some of these techniques . As threshold optimization for Those decision parameters is of primary concern for passive Methods, these techniques are having significant non detection Zones (NDZ) as drawback. To overcome NDZ problem, Active islanding is being adopted where islanding detection is Achieved by grid instability due to disturbance injection into The system operational control . Some active techniques are Slip-mode frequency shift (SMS) , Sandia frequency and Voltage shift and negative sequence current injection . Active Methods have negligible NDZ but false detection is a vital Problem due to overlap of injection parameter with non islanding Events, especially when multiple (DER) are involved in the System.

In this paper a new hybrid islanding protection scheme is Proposed where multiple decision features based binary tree (BT) threshold filter is implemented to avoid false detection And rate of change of PCC voltage harmonic profile is used For grid instability by injecting it to the control dynamics of The voltage source converter (VSC) system. The effectiveness Of proposed islanding protection is measured in terms of run on Time (i.e. Time difference between the instant at which the Islanding occurs and the islanding is detected). This paper is organized as follows: Section II describes The proposed PV-VSC dynamics with multiple (DER) based Micro grid structure. Section III presents the primary P-Q based BFSMC control as well as simultaneous hybrid islanding protection Scheme in terms of stability. Section IV establishes Effectiveness of proposed islanding technique through result Analysis. Finally, Section V concludes the present work.

II. SYSTEM MODEL AND ASSUMPTIONS

1) PV System Modeling:

The real time PV modules are designed on cell level calculation and further recombination in series and parallel is compulsory to meet the power requirement of the module.

2) DC-DC Converter Interface:

As PV is considered as a source of active power (P2), the dc link voltage (Vpv) to the VSC has primary effect in active power reference (P2) to the PCC. This may lead to a major micro grid challenge during considerable change in solar insolation level. To cope with such micro grid issue, a dc-dc boost converter interfacing between PV and VSC is proposed to achieve stable dc voltage (Vpv) across the capacitor (Cpv) for whatever variation that may occur in solar irradiation or in panel temperature.

3) CONTROL DESIGN FOR VSC MULTIVARIABLE DYNAMICS:

The primary PWM control for VSC1 is based on positive sequence active (P2) and reactive (Q2) power at PCC. A new nonlinear back stepping sliding mode control with bounded uncertainty (θ) is proposed for grid stability during non-islanding conditions. With the proposed BFSMC control a simultaneous islanding protection scheme is implemented where rate of change in voltage harmonic profile injection is proposed.

III. PERFORMANCE ANALYSIS

In a grid-connected PV system with dc loads as shown in Fig.1.1, the instantaneous power relationship is given by its value as

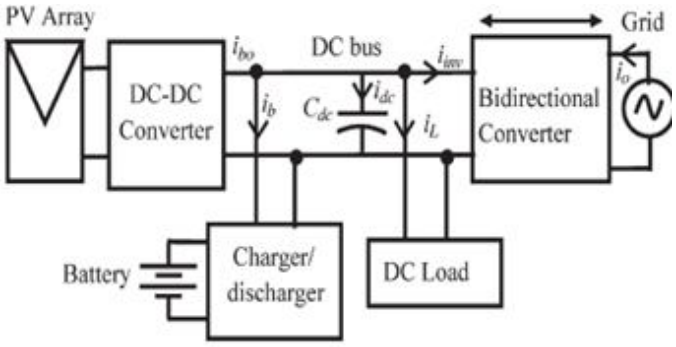

Figure 1. Grid-connected PV system with ac and dc loads.

PMS monitors the battery voltage and generates a mode selection signal for the bidirectional converter, and it also generates the reference current for the hysteresis current controller. The converter mode selection is carried out using predetermined double bands of battery voltages. The outer band corresponds to two voltage limits, i.e., the outer upper threshold voltage (VOUT) and the outer lower threshold voltage (VOLT). These limits correspond to the extreme voltages of the battery, i.e., the float value and the deep discharge level, respectively. Similarly, the inner band voltage limits, i.e., the inner upper threshold voltage (VIUT) and inner lower threshold voltage (VILT) correspond to interior voltage levels for the purpose of control.

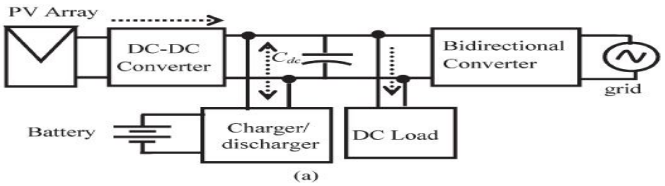

Figure 2. Power flow under various modes of operation of the bidirectional converter. (a) Idle mode.

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IV. RESULTS AND SIMULATION CONDITIONS

The pv input temperature and irradiance that means temperature remaining thing is irradiance. Output of PV voltage and PV current here both PV voltage and pv current are given to MPPT and then MPPT will track maximum power and generate duty cycle of the switch and then given to boost converter. Boost converter will convert variable DC voltage to fixed DC voltage then that dc power is given to the dc link as shown in fig (1).Main aim is to maintain DC link voltage constant. The system consists of a PV array, MPPT technique, a boost converter, a single-phase full-bridge converter, and a charger/discharger circuit for the battery. PV array gives power to the load and sometimes grid will gives the power to the load. The PV array generates voltage. Shape the array consist of five parallel strings with each having two panels in series to get 36 V at the MPP. Whenever reduction in radiation occur then PV current and PV voltage is taken to MPPT then turn ON time of switch will be increased and then

the actual voltage and increased voltage is added and sum of that voltage is step up. MPPT control technique used to generate duty cycle when turn ON and OFF of IGBT switch. If connected to dc source diode and capacitor, whenever switch is ON current flows and Whenever OFF the current flows from dc source capacitor and diode this will act like a load.

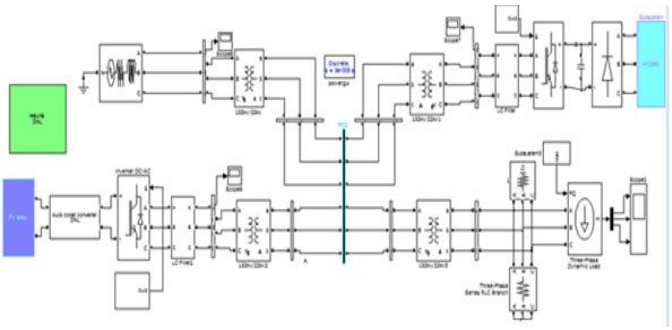

Figure 3. Simulink Model of Power Flow Management in a PV System Supplying Dc Loads.

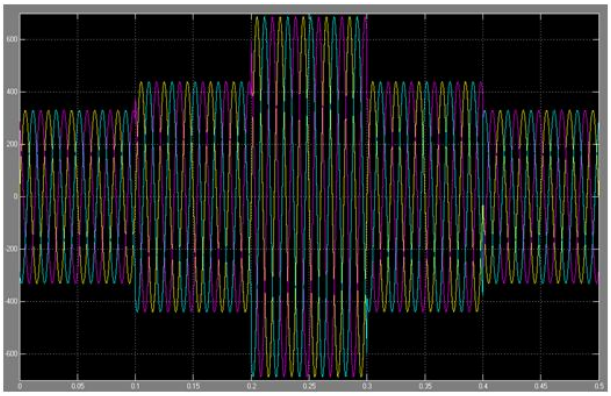

Figure 4.

V. CONCLUSION

From the simulation result it can be validated that the power management strategy of the designed composite model for a grid connected PV array and battery works for both on-grid as well as off-grid mode of operation maintaining constant DC voltage, achieving desired power sharing between the various sources and DC load with full utilization of PV power. For different modes of operation, the performance of converter has been observe for both rectifier and inverter modes. The proposed system provides uninterrupted power to dc load by using PV array and grid. A maximum power point tracker is used for obtaining the maximum power from the solar PV module and conversion to the load. A non-isolated DC-DC converter (step up/stepdown) offers the purpose of conversion maximum power to the load. A DC-DC converter acts as an interface between the load and the module. By varying the ratio of duty cycle the impedance of load as it appears by the source is varied and matched at the peak power point with the source so as to conversion the maximum power.Simulation studies in MATLAB/Simulink environment are presented.

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REFERENCES

[1] Yazdani and P. P. Dash, "A control methodology and characterization ofdynamics for a photovoltaic system interfaced with a distribution network,"IEEE Trans. Power Del., vol. 24, no. 3, pp. 1538–1551, Jul. 2009.

[2] X. Q. Guo and W. Y. Wu, "Improved current regulation of three-phasegrid-connected voltage-source inverters for distributed generation systems,"IET Renew. Power Gener., vol. 4, no. 2, pp. 101–115, Mar. 2010.

[3] H. C. Chiang, T. T. Ma, Y. H. Cheng, J. M. Chang, and W. N. Chang,"Design and implementation of a hybrid regenerative power system combininggrid-tie and uninterruptible power supply functions," IET Renew.Power Gener., vol. 4, no. 1, pp. 85–99, Jan. 2010.

[4] F. Giraud and Z. M. Salameh, "Steady-state performance of a gridconnectedrooftop hybrid wind–photovoltaic power system with batterystorage," IEEE Trans. Energy. Convers., vol. 16, no. 1, pp. 1–7, Mar. 2001.

[5] J. M. Carrasco, L. G. Franquelo, J. T. Bialasiewicz, E. Galvàn,R. C. P. Guisado, M. A. M. Prats, J. I. León, and N. Moreno-Alfonso,"Power electronic systems for the grid integration of renewable energysources: A survey," IEEE Trans. Ind. Electron., vol. 53, no. 4, pp. 1002–1016, Aug. 2006.