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A Novel Control Scheme for both Island And Grid-Tied Inverter Operations

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ABSTRACT

Intentional islanding describes the condition in which a micro grid or a portion of the power grid, which consists of a load and a distributed generation (DG) system, is isolated from the remainder of the utility system. In this situation, it is important for the micro grid to continue to provide adequate power to the load. Under normal operation, each DG inverter system in the micro grid usually works in constant current control mode in order to provide a preset power to the main grid. When the micro grid is cut off from the main grid, each DG inverter system must detect his islanding situation and must switch to a voltage control mode. In this mode, the micro grid will provide a constant voltage to the local load. This paper describes a control strategy that is used to implement grid-connected and intentional-islanding operations of distributed power generation. This paper proposes an intelligent load-shedding algorithm for intentional islanding and an algorithm of synchronization for grid reconnection.

***Index Terms*—Distributed generation (DG), grid-connected operation, intentional-islanding operation, SVPWM.**

INTRODUCTION

ISLANDING is a condition in which a microgrid or a portionof the power grid, which contains both load and distributedgeneration (DG), is isolated from the remainder of the utilitysystem and continues to operate [1]–[4].The disconnection of the DG once it is islanded is required [6]. With the increasing competition among the power companiesto secure more and more customers, the pressure tomaintain a high degree of uninterrupted power service qualityand reliability is felt by the utility companies [7], [8]. Thus, ina deregulated market environment, current practices of disconnectingthe DG following a disturbance will no longer be a practicalor reliable solution. As a result, the IEEE Std. 1547-2003states, as one of its tasks for future consideration, the implementationof intentional islanding of DGs [6].During the grid-connected operation, each DG system is usually operated to provide or inject preset power to the grid, which is the current control mode in stiff synchronization with thegrid [9]–[12]. When the microgrid is cut off from the main grid(intentional-islanding operation), each DG system has to detectthis islanding situation and has to be switched to a voltagecontrol mode to provide constant voltage to the local sensitiveloads [13]–[15]. This paper describes a control strategy thatis used to implement grid-connected and intentional-islanding operations of microgrids. The described methodproposes two control algorithms, namely, one for grid-connected operations and the other for intentional-islanding operations. Specifically, this paper proposes an intelligent load-shedding algorithm for intentional islanding and an algorithm for synchronization for grid reconnection.

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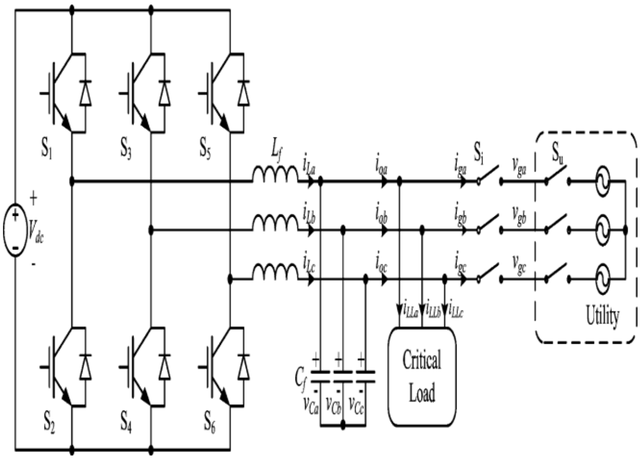

Fig. 1. Schematic diagram of the DG based on the proposed control strategy.

II.PROPOSED SYSTEM

Fig. 1 shows the main circuit topology. This system consistsof the microsource that is represented by the dc source, theconversion unit which performs the interface function betweenthe dc bus and the three-phase ac world, and the *LCL* filterthat transports and distributes the energy to the end use and theload [16], [17]. The controller presented provides a constant DG output and maintains the voltage at the point of commoncoupling (PCC) before and after the grid is disconnected.Under normal operation, each DG system in the microgrid usually works in a constant current control mode in order toprovide a preset power to the main grid. When the microgrid iscut off from the main grid, each DG inverter system must detectthis islanding situation and must switch to a voltage controlmode. In this mode, the microgrid will provide a constant voltage to the local load.

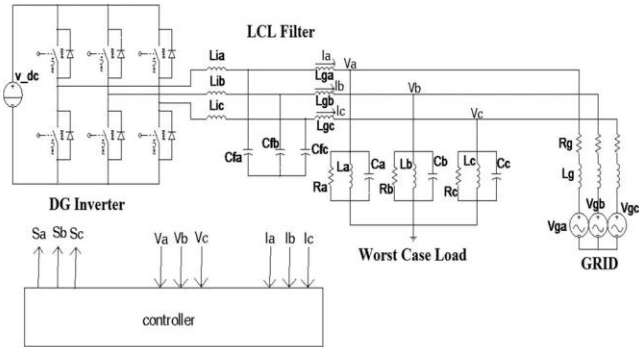

Fig. 2. Schematic diagram of the grid-connected inverter system.

PROPOSED CONTROL SYSTEM

Grid-Connected Operation Mode

For grid-connected operation, the controller shown in Fig. 2is designed to supply a constant current output [8]. A phaselockedloop (PLL) is used to determine the frequency andangle reference of the PCC [18], [19]. An important aspect toconsider in grid-connected operation is synchronization with the grid voltage [20]–[22]. For unity power factor operation, it is essential that the grid current reference signal is in phase with the grid voltage. This grid synchronization can be carriedout by using a PLL [19], [23], [24]. Fig. 2 shows the control topology used.When using current control, the output current from the filter, which has been transformed into a synchronous frameby Park’s transformation (1) and regulated in dc quantity, isfed back and compared with the reference currents *I*DQref.

This generates a current error that is passed to the currentregulator (PI controller) to generate the voltage references for the inverter. In order to get a good dynamic response, *V*DQ is fed forward. This is done because the terminal voltage of theinverter is treated as a disturbance, and the feedforward is used compensate for it [12].The voltage references in dc quantities *V*DQref are transformedinto a stationary frame by the inverse of Park’s transformation(2) and are utilized as command voltages in generating high-frequency pulsewidth-modulated voltages

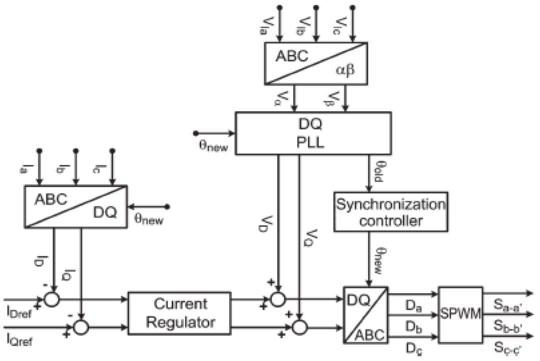

Fig. 3. Block diagram of the current controller for grid connected.

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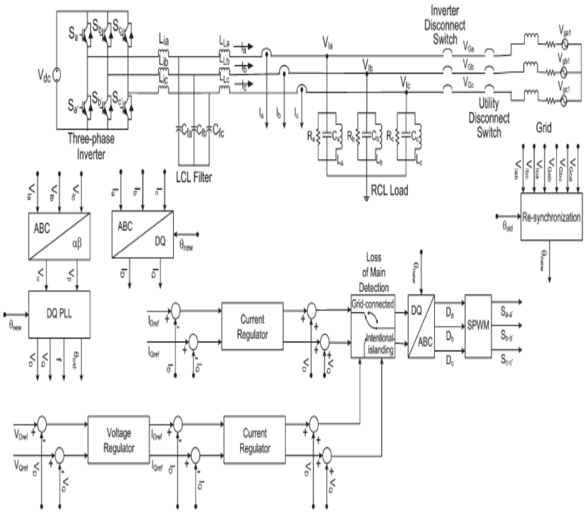

Fig. 4.Proposed Simulated system.

Space Vector PWM enables efficient use of DC voltage.Space Vector Modulation provides excellent output performance, optimized efficiency and high reliability compared to similar Inverters with conventional PWM

IV.SIMULATION RESULTS

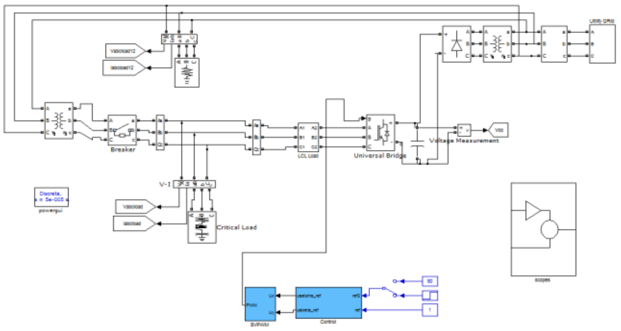

Fig.5 ISLAND Mode Circuit

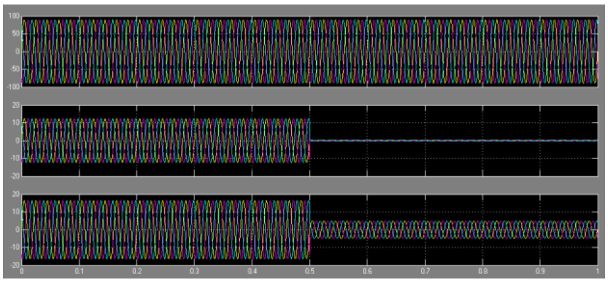

Fig.6 Load Voltage, Grid Current & Load Current

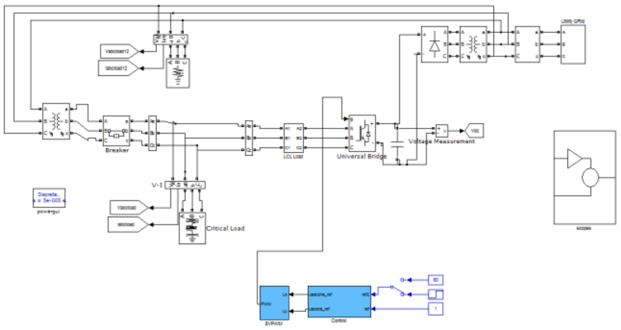

Fig.7 Grid Mode circuit

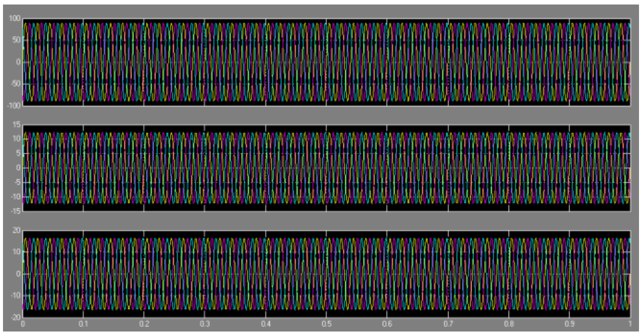

Fig.8 Load Voltage, Grid Current & Load Current

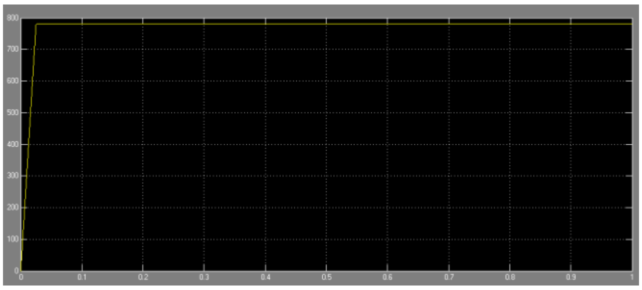

Fig.9 Vdc

V. CONCLUSION

Through this paper, the control, islanding detection, loadshedding, and reclosure algorithms have been proposed for theoperation of grid-connected and intentional-islanding DGs.

A controller was designed with two interface controls: onefor grid-connected operation and the other for intentionalislandingoperation. An islanding-detection algorithm, whichwas responsible for the switch between the twocontrollers, was presented. The simulation results showed that the detectionalgorithm can distinguishbetween islanding events and changes in the loads and can apply the load-sheddingalgorithms whenneeded. The reclosure algorithm causes the DG to resynchronize itself with the grid. In addition, it is shown thatthe responseof the proposed control schemes is capable of maintaining thevoltages and currents within permissible levels during gridconnectedand islanding operation modes. The simulationresults showed that the proposed control schemes are capableof maintaining the voltages within the standard permissiblelevels during grid-connected and islanding operation modes. Inaddition, it was shown that the reclosure algorithm causes the DG to resynchronize itself with the grid.

REFERENCES

[1] D. Jayaweera, S. Galloway, G. Burt, and J. R. McDonald, "A samplingapproach for intentional islanding of distributed generation," *IEEE Trans. Power Syst.*, vol. 22, no. 2, pp. 514–521, May 2007.

[2] J. M. Guerrero, J. C. Vásquez, J. Matas, M. Castilla, and L. García deVicuña, "Control strategy for flexible microgrid based on parallel lineinteractiveUPS systems," *IEEE Trans. Ind. Electron.*, vol. 56, no. 3,pp. 726–736, Mar. 2009.

[3] P. Fuangfoo, T. Meenual,W.-J. Lee, and C. Chompoo-inwai, "PEA guidelinesfor impact study and operation of DG for islanding operation," *IEEETrans. Ind. Appl.*, vol. 44, no. 5, pp. 1348–1353, Sep./Oct. 2008

[4] E. Carpaneto, G. Chicco, and A. Prunotto, "Reliability of reconfigurabledistribution systems including distributed generation," in *Proc. Int. Conf.PMAPS*, 2006, pp. 1–6.

[5] *IEEE Recommended Practice for Utility Interface of Photovoltaic (PV) Systems*, IEEE Std 929-2000, 2000, p. i.

[6] *IEEE Standard for Interconnecting Distributed Resources With ElectricPower Systems*, IEEE Std 1547-2003, 2003, pp. 0_1–16.

[7] H. Zeineldin, E. F. El-Saadany, and M. M. A. Salama, "Intentionalislanding of distributed generation," in *Proc. IEEE Power Eng. Soc. Gen.Meeting*, 2005, vol. 2, pp. 1496–1502.

[8] S. Alepuz, S. Busquets-Monge, J. Bordonau, J. A. Martinez-Velasco,C. A. Silva, J. Pontt, and J. Rodriguez, "Control strategies based on symmetricalcomponents for grid-connected converters under voltage dips,"*IEEE Trans. Ind. Electron.*, vol. 56, no. 6, pp. 2162–2173, Jun. 2009.

[9] G. Franceschini, E. Lorenzani, C. Tassoni, and A. Bellini, "Synchronousreference frame grid current control for single-phase photovoltaic converters," in *Conf. Rec. IEEE IAS Annu. Meeting*, 2008, pp. 1–7.

[10] C.-S. Wu, H. Liao, Y.-B. Wang, Y.-C. Peng, and H.-H. Xu, "Design ofintelligent utility-interactive inverter with AI detection," in *Proc. 3rd Int.Conf. Electr. Utility DRPT*, 2008, pp. 2012–2017.

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