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Islanding Operation of Distributed Generation system with Grid control

TEJASKUMAR A PRAJAPATI[1], SWAPNIL V ARYA[2]

[1] M.Tech Electrical Engineering, BVM Engineering College, Vallabh Vidyanagar, India
[2] Assistant Professor, Electrical Department, BVM Engineering College, Vallabh Vidyanagar, India

Abstract ***—Islanding Operation represent a condition in which an inverter based distributed generation system supplies power or energy to the local load/customer due to any types of fault or grid failure, maintenance and repair of grid. To provide reliable power supply to the critical loads as well as non critical loads, islanding with grid reconnected can be a possible solution with a proper strategy and design control scheme. The constant current technique detects utility supply continuous and if any fault then constant voltage technique mode is operated. This paper shows that an intentional islanding operation of DG system with gird reconnected after fault is clear is presented. In hardware model the pic controller use as a control circuit with programming.***

Keywords-component;- ***Inverter based DG system; distributed generation (DG); intentional islanding algorithm; Point of common coupling (PCC); PLL; Islanding Operation; grid reconnected technique***

I. INTRODUCTION

In last few years, distributed generation systems (DG) have become more popular in many industries and emergency applications like as hospital due to the lack of coal availability. In future it is very hard to get electricity from the coal plant. The power system network consists of G, T AND D means generation, transmission and distribution network and low voltage distributed networks are work as a radial. The supply flows from upper (high) voltage level to down (lower) voltage level along the radial feeder, so there is unidirectional flow. DISTRIBUTED Generation are more importance and play role in the recent years and lead to a new approach in the distribution system operation.

Intentional islanding of inverter based DG system become popular because high penetration in DG system and energy supplied to consumers. The inverter based DG system used to provide supply the load, so these have many benefits to the DG consumers. Intentional Islanding can upgrade the power supply quality and trust ability [1]. Now a day; the technical evolution, environmental policy, and extension of the commerce and economics electrical network are build up new program in the sector of the generation side [15]. Recent technology allows the energy to be produced by small sized plants. To rising the use of non-conventional sources in order to less effect on environmental factor like as pollution [15].

In this concept, few of the energy is provided/supplied by the grid supply (grid) and the inverter based distributed generation system supply energy during grid failure. The electrical supply constant and reliable provides to the customer or load.

There are many control schemes or strategy for the intentional islanding operation of Distributed Generation system such as active, passive, non detection zone (NDZ) but different applications with different control scheme and in these schemes use passive method. Search in the last year has been motivated to study the possibility of intentional islanding. In, a controller technique to intentionally island DGs was proposed that uses only locally measurable parameters as a voltage, current, frequency [6]. The switching between grid connected mode and grid disconnected mode by circuit breaker (CB) with no communication link between the DG and grid network. The constant current control technique consists of current control loop with measure current grid and the voltage Control technique can support the grid during islanding operation to provide constant voltage to the load [1]. The DG is generating few amount of power or energy. The IEEE defined the DG system is not directly connected to the large amount of transmission line. This distributed energy resources are depending on fuel availability, fuel cost and locating area. The inverter based DG is "an energy resource of electrical power connected to the distribution network as consumer side" [7].

This paper represents a control technique or strategy for grid connected mode and grid disconnected mode. In normal condition the controller is provide constant power/current to the local load if grid supply available and if any types of fault in grid supply that time measure the voltage and frequency at point of common coupling (PCC) and controller operate as constant voltage control mode and provide voltage to load. After the fault is clear, the controller detects grid voltage at PCC compare with reference signal at that time grid is reconnected and provide supply to load. There are two technique use for load shifting is current control and voltage control technique.

II. SYSTEM DESCRIPTION

A grid system consists of 400 volt three phase ac supply of distribution network. A PCC means point of common coupling can be modeled as a controllable 3 phase circuit breakers (CB) and time-based controllable switch that opens and closes its contacts according to defined operation time [3]. It plays important role as an interface between the Distributed system and grid system. A phase locked loop (PLL) is a device that matches the phase of output signal with input signal phase and consists of loop filter (remove variation) and Voltage Controlled Oscillator (VCO). The current notches or harmonic produce at the output side of IGBT/diode type inverter, a LCL filter is designed to eliminate that harmonic [13]. In LCL filter, inductor (L) on inverter side to limit the current ripple and capacitor (C) to reduce the current ripple or harmonic. IGBT type Inverter converts dc voltage into ac voltage with desired frequency. Another component can be used for make a hardware model such as a CT/PT, Microcontroller (pic16f877), LCD display (2x20) , Diodes, Capacitor 470uf/100uf , 5v regulator (IC-7805) with heat sink, Resistance/ VAR RES, LED , LM358 operational amplifier, Transistor (BC547), Mosfets, Battery, Transformer, Relay.

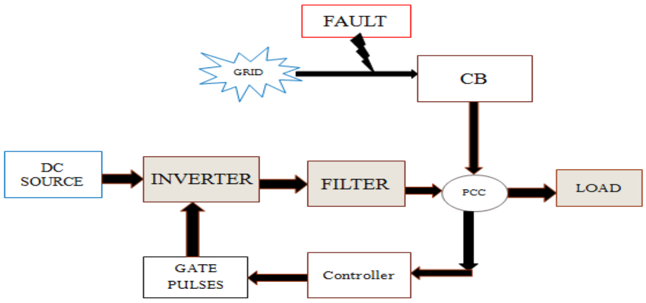

Figure 1. Single line diagram

III. CONTROL STRATEGY

Automatic Load shifting is a process in which a part of the system load is connected or disconnected according to a certain priority in .which system has power supply available that load is connected that means provide continuous supply it. During the grid-connected mode, the utility supply is operated to provide the power to the load according to many factors such as the availability of energy, energy cost, and so on [1]. When the main power grid is out (power outage) if any fault, the DG that continues to inject predetermined power can cause voltage and frequency transients, this transient variation can be reduce by PI controller.

To find out the frequency and angle reference of both system by 3 phase PLL at point of common coupling [2]. The 3 phase voltage or current is converted into 2 phase (dq) by park's transformation theory and 2 phase to 3 phase signal converted by Clark's transformation in this current signal is compared with current reference which is being given to current regulator to regulate the signal and given to PWM block [5]. Voltage regulator generates the current reference signal which is being used to compensate the voltage signal and this current signal is compare to load current (Id and Iq) [5]. Then the error is given to a PI controller (current regulator) through current compensation and compared with load voltage, generate the high switching signal directly given to PWM. This controller detect the voltage at few interval and according to operate the current technique and voltage technique, provide supply it [11]. This controller is a combination of both this techniques.

The error between inverter current and current reference by PI controller and input to this controller is dc signal. This controller decreases the steady state error and generates high frequency switching signal to PWM. [3].

This control system was work normally in grid-connection mode. The grid was disconnected if fault occur at 0.090 sec and this calamitous event was determine at 0.091sec. After 0.1 sec, the controller system was changed utility to DG system and after 2.0 sec the fault is clear the grid is reconnected automatically.

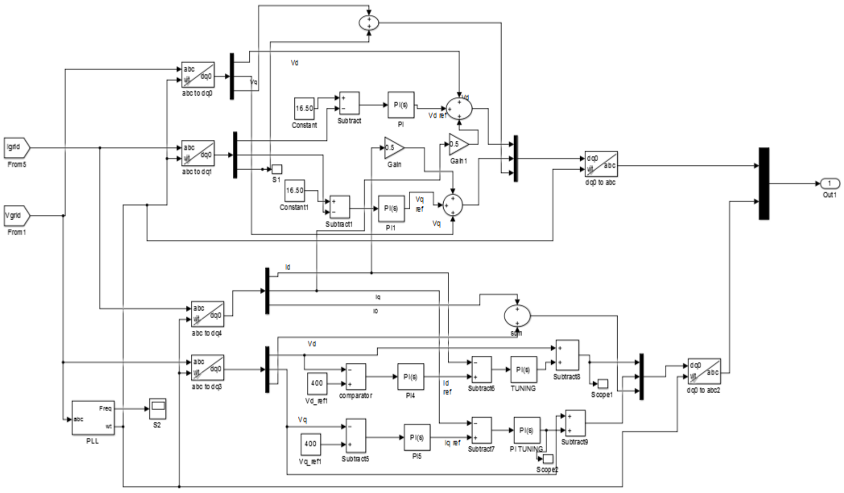

Figure 2. Control technique

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IV. SIMULINK RESULT

Show the simulated result using MATLAB-2014.

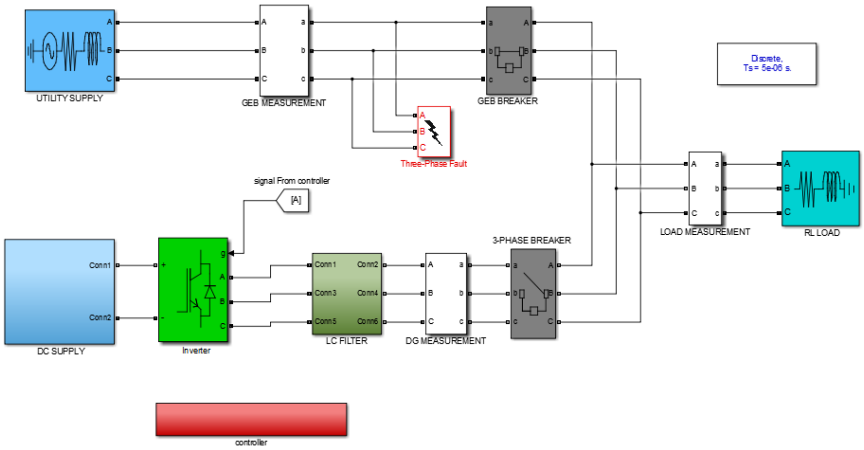

Figure 3. Simulation model

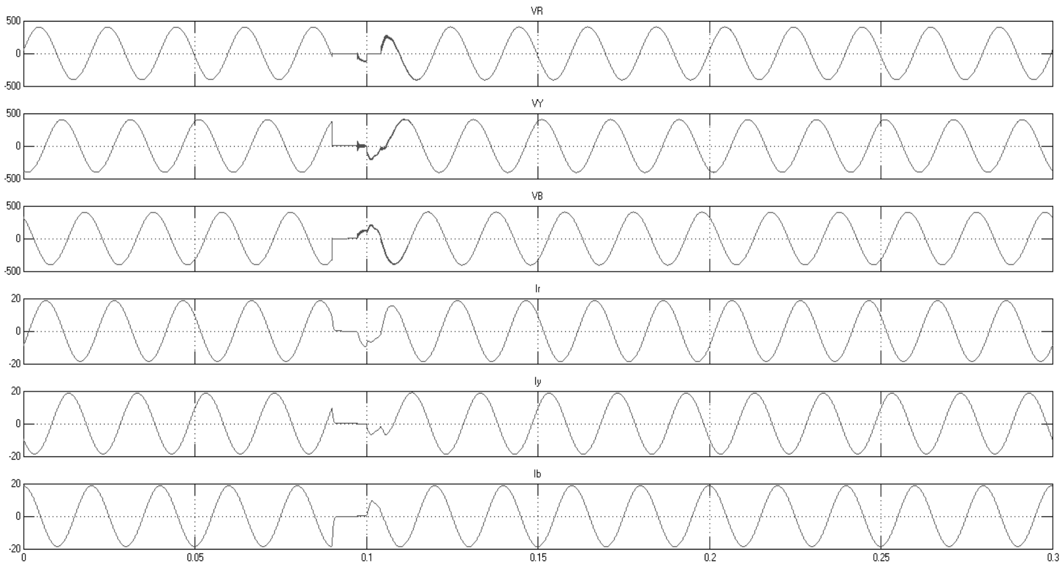

Figure 4. Phase voltage and current

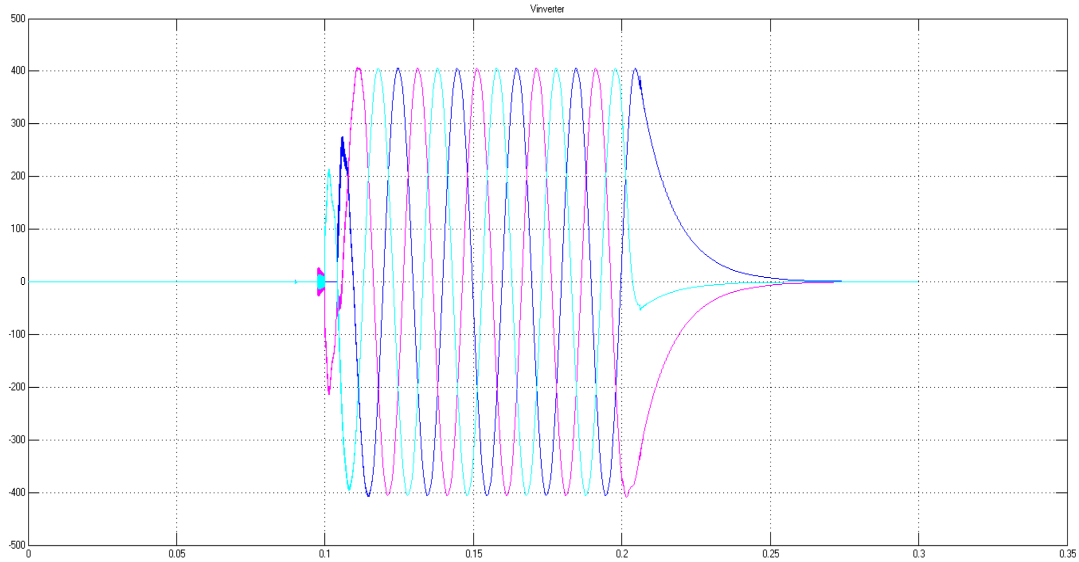

Figure 5. Inverter voltage

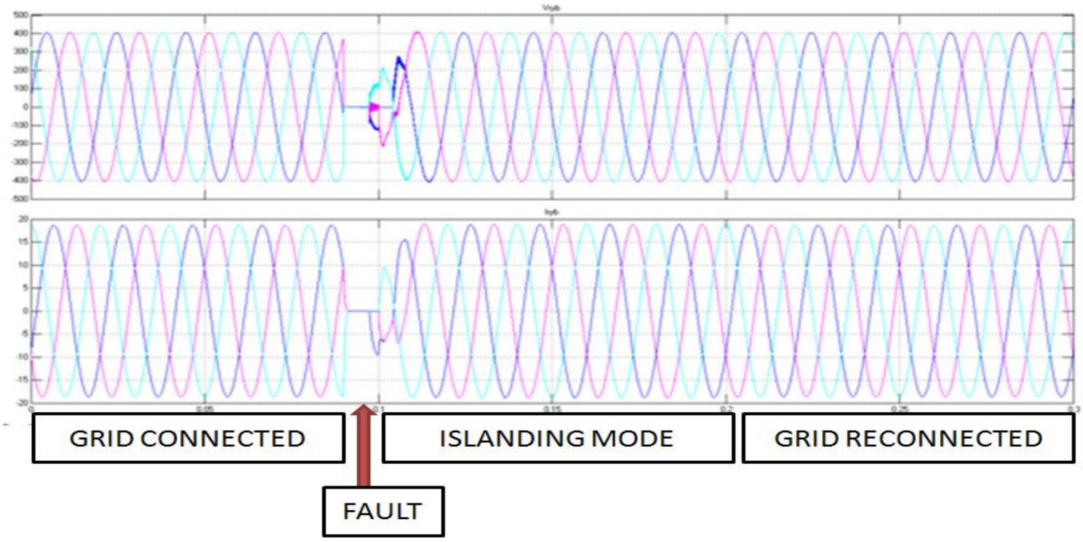

Figure 6. Grid mode to islanded

Figure 7. Hardware model

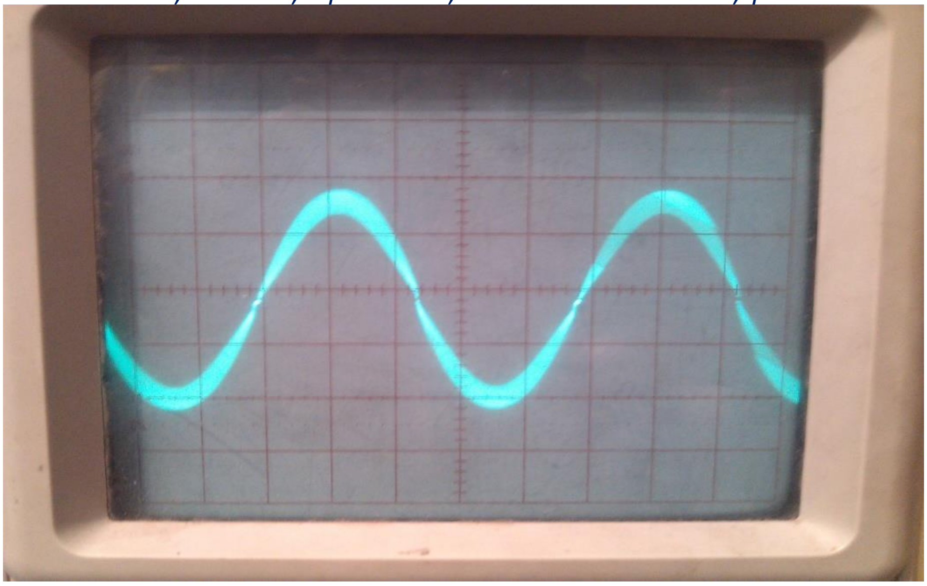

Figure 8. Output voltage of model in CRO

V. CONCLUSION

In this paper a controller technique was employed, for grid connection mode, islanding mode and grid disconnected mode The result of hardware and simulation, both show that the control technique is capable to maintaining frequency and voltage within standard level during fault time and reconnection of grid. This controller technique provides constant supply to the local load during grid supply failure. The hardware model run successfully and show that grid and inverter parameter in lcd.

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