International Journal of Electrical Engineering.
ISSN 0974-2158 Volume 6, Number 4 (2013), pp. 485-492

http://www.irphouse.com

Anti-Islanding Detection Technique of Interconnected Distribution System using Simulink

Anuj Harsh and Er. Preetinder Singh

GNDEC Ludhiana, Punjab Technical University

Abstract

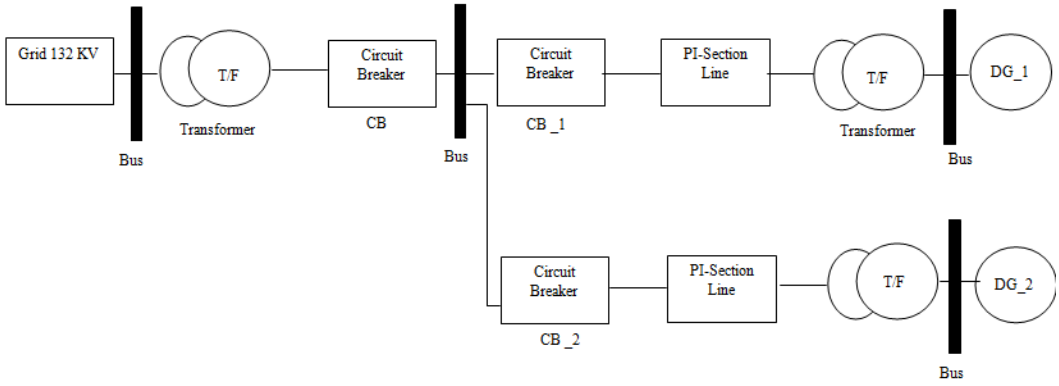
In today power system scenario the one main problem rise in the interconnected grid system is islanding. To detect that condition of islanding in power system a proposed model have prepared in Matlab Simulink Software with their tool used SIM POWER SYSTEM. In this model used of wind turbine and it's driven by synchronous generator. As soon as condition of islanding occurs in the proposed model, circuit breaker gets tripped. This is used to detect the condition of islanding in the system. In addition to it, the change of voltage and current of the system upon islanding is also reflects this condition. Change in Active and reactive power of the system is also exploited in the islanding situation and after that circuit breaker tripping is also studied in the paper.

Keyword – Circuit Breaker, Islanding, Synchronous Generator, wind turbine

1 INTRODUCTION

The term "ISLANDING" refers to the condition in which a distributed generator continues power to a location even though electrical grid power from the electric utility is no longer present. It can be dangerous to the utility worker who may not realize that the power is still in the circuit and in the automatic reconnection of the device. Anti islanding term is used when the distributed generator detects islanding and stops producing power immediately. It becomes electrically isolated from the remaining power system that is continuously energized by DG which is connected to it. . Any active power generating source which is not in distributed system traditionally causes faulty transmission line that does not get power. This condition is not valid now-a-days. These days in case of islanding all the electric utilities which are disconnected from the grid require DG. Islanding can be intentional, and non-intentional. During serious monitoring of the utility grid that causes this condition, it is shut down. Installed frequency and voltage regulators both cause intentional

Islanding equation operations. It is not the influenced behavior of island system. It can be done with the minimum flow of load to or from the main grid. Non Intentional islanding causes an imbalance in the production of load during a maximum load flow to or from the main grid. In the islanding energy a surplus of active power is stored in the rotating part of the M/C. The frequency being reason for this increased speed of generator. The DC link voltage increases when PEC unit is stored in DC link and its reverse is done when there is taking active power, this creates an unbalance in the voltage level due to the reactive power. The excess of reactive power plays the same role as that of shunt capacitor and thus the voltage is increased naturally when there is shortage of reactive power. The survival of an island largely depends upon the effect of large amount of power unbalance in a new island and in the case when there is no voltage or frequency regulation in the island with perfect production balance and survived very well for long time. Islanding is not always so easy to understand because the power systems are complicated. They are automated vigorously that spread internationally and many continent for all the faults and contingency that occur very regularly are cleared automatically without any intervention of human being. The power system is saved when the utility is safe. Humans, animals and the equipment connected to the grid collectively are in danger when there is supply of heavy load electricity. There is huge risk to the workers who are sent out for the maintenance work in the islanded by system, if the part of power system forms on uncontrolled island get in contact with that part of the equipment where the electrical supply in maximum. This can result into severe injury and even death. So it is very important to shut down that unintended electrical island in many distribution feeders to give protection against islanding.



Single Line Diagram of Multiple DG'S In Distribution Network

4.3 How the model work:

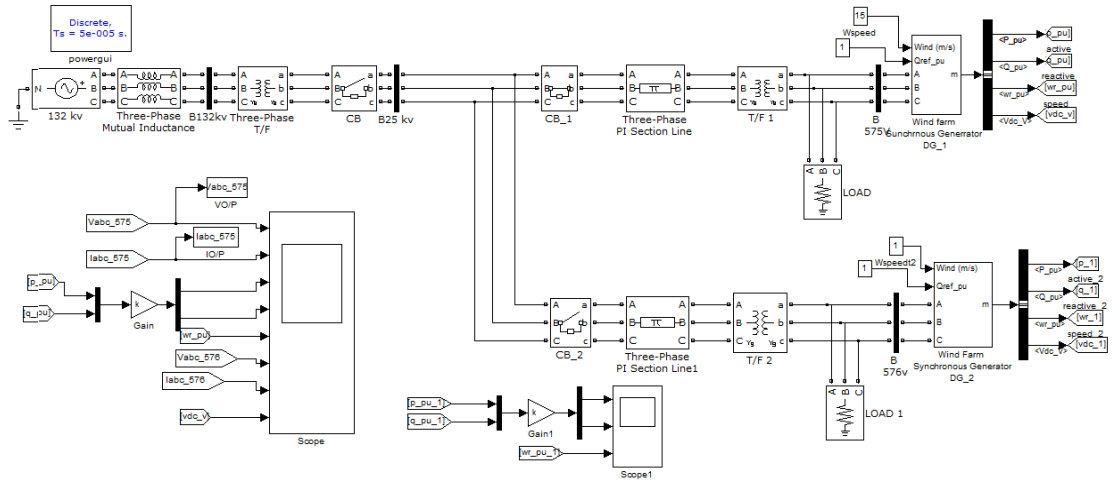
In the "Islanding detection PROPOSED MODEL" Distribution energy resources wind farm have used for generation purpose of electricity which have been driven by synchronous generator. The power produced by wind is wind power and its convert that wind energy into useful electrical energy for generating electricity. The used of

wind turbine to make electrical power and windmill for producing a mechanical power. Large wind farm make of hundred of individual turbine and they have connected with transmission system of system of electrical power. In proposed model used of 5 wind turbines in one wind farm for generation of electrical power. To generate electricity with wind energy resources it is renewable energy resource, widely distributed, clean, and used a little land for itself. About the speed of wind is different at different locations it depend upon the below of wind that have flow in the particular location. In detection model of islanding we have connected multiple DG and they have parallel to each other and make an interconnected DG system and they have useful for detect the condition of islanding in which DG have isolate from main system. In this detection model in a wind farm each turbine is inter-connected to individual medium voltage, of electrical network. Then electrical supply generate from wind turbine they feed from feeder to the distribution network of grid in this transformer are connected which increased the voltage as per its requirement. . It is a proposed interconnected grid system which has been design in MATLAB SIMULINK MODELING with tool used sim power. In this proposed model we have to protect the inter-connected grid system from the island condition or non-island condition. The possible islanding and non islanding condition which we have work and study on it and how the changes come occur in power of wind turbine are given below:-

- Tripping of main circuit breaker when situation of island occur in the system
- Changed load at DG site

The island condition occurs at .3 sec...When this condition occurs, it means that grid system will be at island mode. In this condition the current will be suddenly goes to increase and voltage will be decrease. When changes the load from resistive load to resistive and inductive load in the islanding condition. In this situation of islanding; when CB_1 is closed and they have been open after .3 second. After circuit breaker open active power P_pu will be decrease from its set point and it's also affect on the reactive power Q_pu

Simulation Model:-The behavior of the simulation has must be similar to that conditions in which real part of the situations have been happened. Simulation has done in MATLAB with tool used sim power system and it will be run in discrete time 0.05s. The model has been designed in MATLAB Library to fulfill our condition like interconnected grid system. For generation of electricity the wind turbine synchronous generator is used in simulink model for detection of islanding. The working of wind turbine synchronous generator in the proposed model in that way it is the combination of wind turbine and synchronous generator. They have used convertor AC/ DC/AC and it's further divided in to two convertors rotor side converter (Crotor) and grid side converter (Cgrid). The capacitor is also connected on the DC to improve the power factor and it's have act as DC voltage source. The power generate by wind turbine is then converted into useful electrical power by synchronous generator and the transmitted to the grid with the help of stator and rotor winding.



Grid connected mode the normal condition: In figure 1.1 scope diagram of matlab under tool Sim Power System its show that at normal condition when multiple DG connected in the proposed model like DG_1 and DG_2 are connected in model at grid connected mode. At this mode; in scope diagram the first waveform across DG_1 is show that voltage of Vabc_575 and second is show that waveform of Iabc_575. In normal position both the waveform have pure sinusoidal. In next waveform its come across P_pu, Q_pu, Wr, and Vdc in this the value of active power is show the graph at normal running position when grid have taken the value from its set point given to load which have connected to DG_1 and rate of flow of wind speed at constant value which is given at 15 m/s. On the other hand voltage and current waveform of bus Vabc_576 and Iabc_576 are also show that pure sinusoidal at grid connected mode.

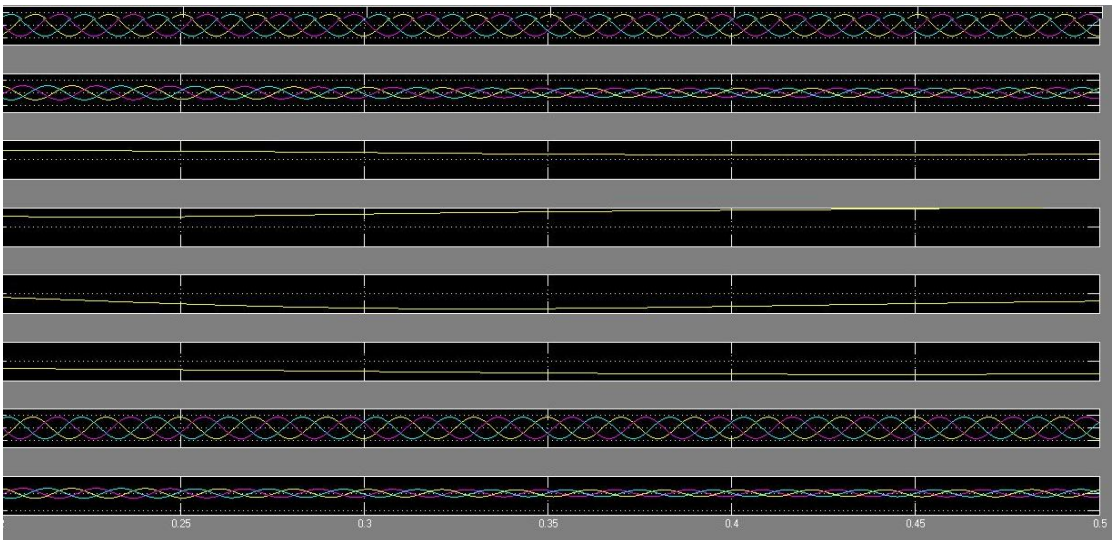


Fig. 1.1 Normal Condition Scope Diagram

2ND Condition is islanding condition at DG_1:-In islanding connected mode that condition occurs in the system when grid is connected in to islanding mode. That situation of islanding have detect in that manner by using and analysis with the help of passive technique which have tell the condition of islanding with the help of changing in voltage and current graph the amplitude, phase difference is changed when the condition of islanding occur it shown on the figure 5.2 of scope diagram. In this the CB_1 have trip in 3.5second which connects across DG _1tand detect the condition of islanding show the value of voltage and current been affected. The value of Vabc_575 have change its decrease after .3 second and changes occur in amplitude and value of Iabc_575 also affected it's have change after .3second it's have increase from its value. The reason is that part of the power system have disconnected from main utility system in that condition the value of active and reactive power wind speed is also affected and its change after the islanding condition have occur in the distribution generation source. The circuit breaker has open at the time of .3second to .45 second. But in that the value of voltage and current have not affected of DG_2 it's remain same as pure sinusoidal

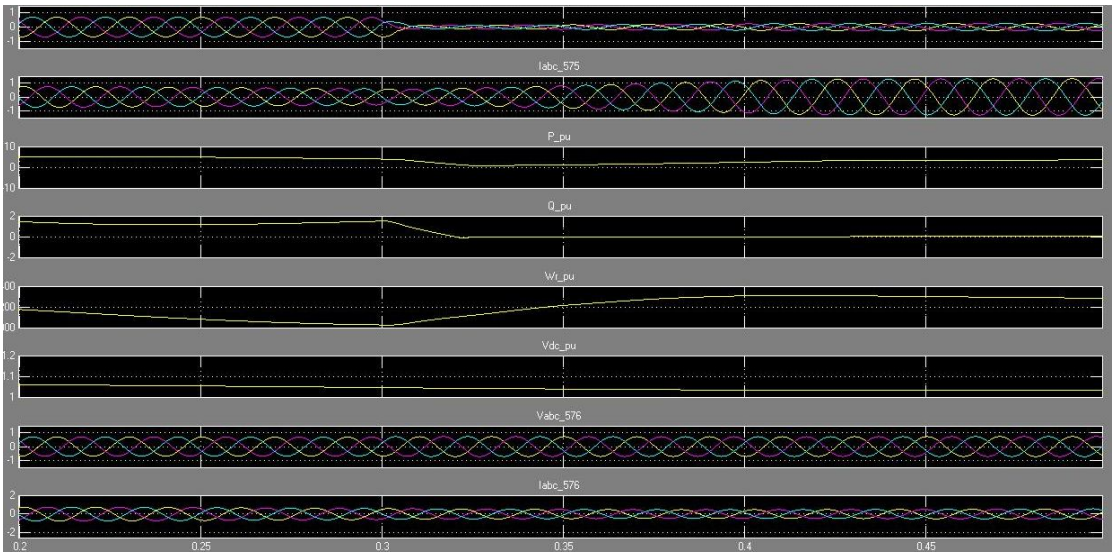


Fig. 1.2 At Islanding Condition DG1_CB_1 Scope Diagram

3RD Condition is islanding condition at CB_2:-In islanding connected mode that condition occurs in the system when grid is connected in to islanding mode. That situation of islanding has detected in that manner; by using and analyses with passive technique which have tell the condition of islanding with the help of changes occur in voltage and current graph. The amplitude, phase difference is changed when the condition of islanding occur it shown on the figure 5.2 of scope diagram. In his the CB_2 have trip in 3.5second which is connected across DG _2tand detect the condition of islanding show the value of voltage and current been affected. The value of Vabc_576 have changed its decrease after .35 second and changes occur in its

amplitude and value of Iabc_576 also affected it's have change after .35 second it's have increase from its value. The reason behinds that part of the power system have disconnected from main utility system. In that condition the value of active and reactive power wind speed have also affected and its change after the islanding condition have occur in the distribution generation source. The circuit breaker has open at the time of .35second to .45 second. But in this case the value of voltage and current have not affected across DG_1 it's remain same as pure sinusoidal.

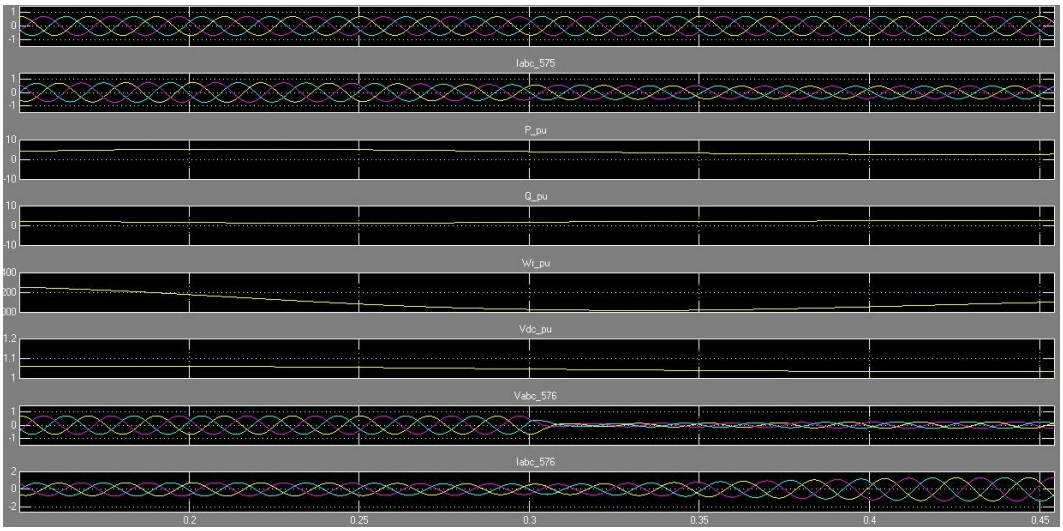


Fig.1.2 AT Islanding Condition DG_2_CB2 scope diagram

Changes in Active and Reactive Power:-In next part of the paper its analysis that when a load changes across distribution generation source. Now RL load in connected parallel with both the DG's. In that condition active and reactive power of the wind turbine has affected. The change of load in condition of islanding the graph of active power is decrease from its original value as shown that in the scope diagram of 1.4. The reactive power have also affected due to sudden change in load. Its value has decrease from its original position where its first connected at grid connected mode.

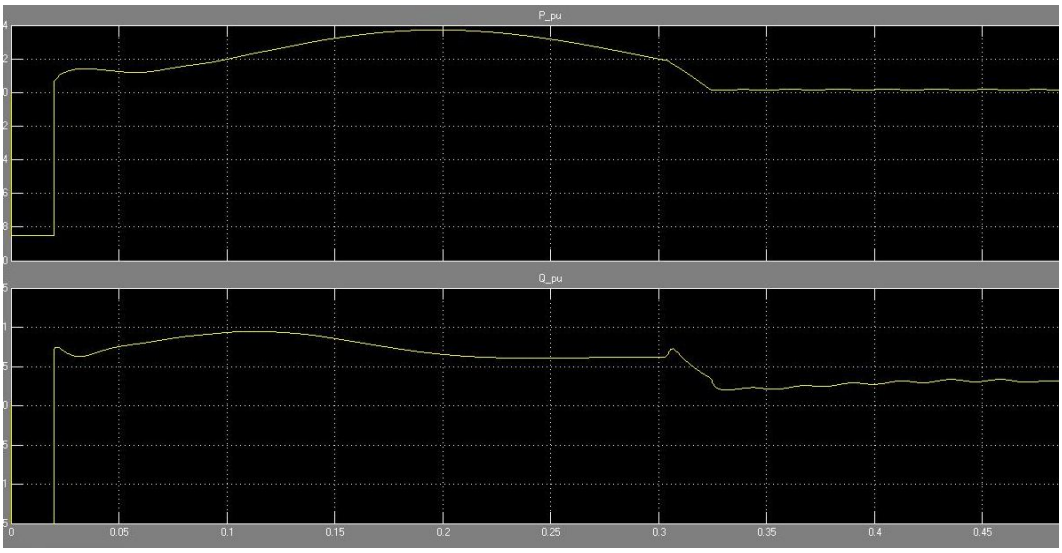


Fig. 1.4 changes occur in active and reactive power at islanding condition

Conclusion

In today's power system; there are a few issues which are not resolved yet. From this issues one main issue is raise its fast and very accurate detection of islanding. It is most challenging concept in today power system scenario. In the power distributed system an islanding is operations in the failure to improve proficiency, excellence, reliability and quality of supply. In this paper the technique used is proposed which have done in simulink on the bases of model which have driven by synchronous generator with distribution energy resources. It is very affected and given good result. In this circuit breaker is used; across the system which normally in closed position but when the transition time finished circuit breaker is automatically open and they detect the condition of the islanding. In this condition of islanding voltage will be unbalanced and becomes low from its original value and current is also affected it's become high from its original value after tripping of circuit breaker. When we changed load in the proposed model it's also its affect on active and reactive power of the system.

REFERENCE

[1] Chang-Tao Hsieh, Jeu-Min Lin, Shyh-Jier-Huang, "Enhancement of Islanding Detection of Distribution Generation System via Wavelet Transform based approaches", Electrical Power and Energy System, Vol. 30,pp.375-580. August 2008.

[2] Fariba Gharedlaghi, Henieh Jamali, Mansoureh Deisi and Aftefi Khalili, International Journal of the Physical Science, Vol. 6(23), pp. 5540-5549, 9 October 2011.

[3] Gupta, B.R. "Generation of Electrical Energy", Euresia Publishing House (Pvt.) Ltd., New Delhi, 2003.
[4] H.H. Zeineldin, T. Adbel-Jalil, E.F. Saadeny, M.M.A. Salema, "Islanding Detection of Grid Connected Distributed Generator:, Electrical Power System Research, Vol. 77, Feb. 2007, pp. 155-162.
[5] J.A. Peces Lopes, C.L. Moreira, F.O. Resende, "Microgrid Blackstart and Islanded Operation ,"15th PSCC Liegc 22-26 August 2005 Session 27.
[6] Jae-Hyung Kim, JunGukim, Young-Hyok J, Yong Chae Jung, Chung Yuen Won, "An Islanding Detection Method of Grid Connected System Based on the Geortzel Algorithm", IEEE Transaction on Power Electronics, Vol. 26, No.4, April 2011, pp. 1049-1055.
[7] Jose C.M. Vieira, Diogo S. Correa, Wilisum XU, "Performance Curves of Voltage Relay for Islanding Detection of Distributed Generators", IEEE Transaction on Power System, Vol. 20, No. 3, August 2005, pp. 1660-1662.
[8] M. Robitalle, K. Agbossou, M.L. Doumbia, R.Simard, "Islanding Detection Method for a Hybrid Renewable Energy System", International Journal of Renewable Energy Research, IJREC, Vol. I, No. 1, pp. 41-53, 2011.
[9] Mohammad H. Moradi, Eidy Habadi, "Hybrid Performance of Fuel Cell and Wind Turbine in Islanding Operation Mode", All Life Science Journal, 2012; 9(3).
[10] Nagrath, I.J., Kothari, D.P., "Power System Engineering", 13th Edition, Tata Mcgraw-Hill, 2003.
[11] Noradin Ghadimi, A New Active Technique Based 3th Current Harmonic Injection in order to Islanding Detection", American Journal of Scientific Research, ISSN 1450-223X Issue 41, pp. 71-77, 2011.
[12] W. Freites, X. Wilsum, C.M. Veria, "Characteristic of Vector Surge Relays for Distributed Synchronous Generator Protection", Electrical Power System Research, Vol. 77, pp. 170-180, Feb. 2007.
[13] Xizoyu Wang, Walmir Feritas, Venkata Dinavehi, Wilsum Xu, "Investigation of Positive Feedback Anti-Islanding Control for Multiple Invertor-Based Distributed Generators", IEEE, Transaction on Power System, Vol. 34, No.2, pp. 785-795, May 2009.
[14] Yousry Atia, Mohamed Zahran, Mahmoud Salem, "A Developed Passive. Anti-Islanding Hybrid Method for Distributed PV Systems", The Online Journal on Electronics and Electrical Engineering (OJEEE), Vol. 3, No. 3, pp. 430-437.