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Detection of Islanding in Micro-grid Connected with Distributed Generation

Pal Shivamkumar S¹, Singh Shailendra R², Vishwakarma Shubham R³,

Savani Sagarkumar M⁴, Shani M Vaidya⁵

B.E Student, Department of Electrical Engineering, Vidhyadeep Institute of Engineering and Technology, Anita, KIM,
Gujarat, India.¹

B.E Student, Department of Electrical Engineering, Vidhyadeep Institute of Engineering and Technology, Anita, KIM,
Gujarat, India.²

B.E Student, Department of Electrical Engineering, Vidhyadeep Institute of Engineering and Technology, Anita, KIM,
Gujarat, India.³

B.E Student, Department of Electrical Engineering, Vidhyadeep Institute of Engineering and Technology, Anita, KIM,
Gujarat, India.⁴

Assistant Professor, Department of Electrical Engineering, Vidhyadeep Institute of Engineering and Technology, Anita,
KIM, Gujarat, India.⁵

ABSTRACT: The advance and technology in and new innovation in power quality electronics. The consumer requires better power quality and also continue power supply. This cannot achieve by convectional power grid so it's alternate option is micro grid. The micro grid is best option for continue power supply it is basically work on renewable source like wind energy photovoltaic etc. MG work on both mode standalone and interconnected mode. In standalone mode it works without any grid connection but in interconnected mode it is couple with main grid. In case of interconnected mode when it operates alone due to grid failure it is called islanding. But some issues come in islanding mode which are human safety, inverter safety and power quality disturbance like frequency variation, voltage swell and shrink harmonics distortion so, it important to detect islanding, power quality issues by various detecting methods.

KEYWORDS: Islanding, Islanding methods, Distributed generation, Micro grid.

I. INTRODUCTION

Recent Economic growth around the world has created the increased demand for Electric power not only in major cities but also in rural and remote locations. This demand for power cannot be met with conventional grid system due to over loading of existing lines, with associated losses, Complexity as well as high cost of installation of new lines for rural and remote locations. One of the emerging solutions for such demand for power is microgrid or distributed generation. In last few years of micro grid and islanding widely spread over. To overcome this problem and difference of demand and supply of electrical energy and continuous power supply is more necessary to increase we know all the electrical power and distribution system are interconnected with each other in common grid way, so it gives reliability and flexibility of continuous power supply. When micro-grid or small portion of whole interconnected system is disconnected from main utility system then it's called Islanding. During islanding conditions uninterrupted power supply to critical load is maintained even in case of main grid failure. In case of disruption in main grid, section of grid happens automatically intentional islanding and unintentional islanding. It results number of power quality issues and human safety concern. Large variation in frequency, voltage, current and harmonic distortions some time become very

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harmful for utility. This paper mainly focusing on the working of islanding detection technique. MG playing a key role in maintaining power quality (PQ) and reliable power supply. When connected with main grid, it introduced issues and the DG source energizes the critical load until the main grid is resynchronized with DG.

The situation of islanding can be distinguished in two types:

Intentional Islanding and **Non-Intentional Islanding**. In case of **Intentional islanding**, when the maintenance is necessary for the specific part or portion of micro-grid and it is disconnected from main grid it's called **Intentional Islanding**. Where in **Non-intentional islanding**, it is not planned to disconnect intentionally but it is disconnect due to any types of fault.

Section II The work in this paper is divided in Two stages. 1) Islanding Detection Technique 2) Islanding Protection Paper is organized as follows. Section III Description about Distributed Generation and Section IV presents MATLAB SIMULATION showing results of images tested. Finally, Section V presents conclusion.

II. LITERATURE SURVEY

1) ISLANDING DETECTION TECHNIQUES

The main philosophy of detecting an islanding condition is to monitor DG output parameters and system parameters and to check whether islanding has occurred due to change in these parameters. Islanding detection techniques can be categorized as remote and local techniques. Local techniques can be subdivided into active, passive and hybrid techniques.

a) Remote Islanding Detection Technique

These techniques are based on communication between utility and DGs. But these are very expensive to implement. Traditionally only utility owned wires and channels subscribed from public telephone companies have been considered. Today radio transmitting (FM or AM) and optic fibres can be added to the list.

b) Local Islanding Detection Techniques

Local detection method is based on the measuring parameter like voltage & frequency; and it is use on the DG side. Local detection method is usually classified the (i) Active method, (ii) Passive method and (iii) Hybrid method.

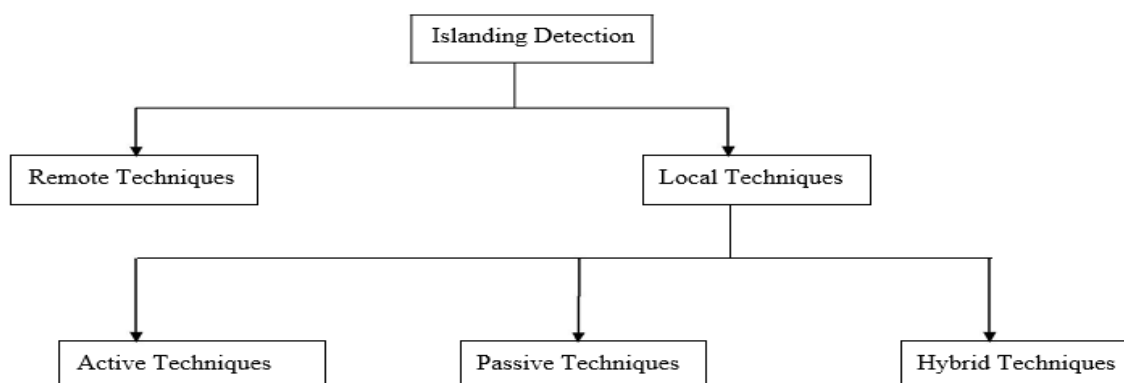


Fig 1 : - Block Diagram of Islanding Detection Techniques

i) Active islanding detection techniques

When the generation and load perfectly match, even then the islanding can be detected with the active islanding techniques which is not possible in case of passive detection techniques. Active methods directly interact with the power system operation by introducing perturbations. The idea of active detection method is that this small perturbation will result in a significant change in system parameters when the DG is islanded, whereas the change will be negligible when DG is connected to

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Vol. 7, Issue 3, March 2018

- the grid.
 - ii) Passive detection techniques
Passive methods work on measuring system parameters such as variation in voltage, frequency, harmonic distortion. The difference between the islanding and grid connected conditions is based on the threshold values set for these parameters. These techniques are fast and don't introduce any disturbance in the system.
 - iii) Hybrid detection techniques
Hybrid methods employ both the active and passive detection techniques. The active technique is implemented only when the islanding is suspected by the passive technique.
- 2) ISLANDING PROTECTION
- The principal objective for an islanding protection technique is to detect the condition where the DG unit is left connected to a portion of the utility's load network, but disconnected from the main source of utility power following a switching operation. When an islanding condition is detected, the protection should trip the intertie breaker between the generator's site and the utility. Once this has been done, the presence of the DSG unit will not impede the orderly restoration of the utility supply to the rest of the network. Since the intertie breaker is used to connect two active systems, once the network supply has been established, the DSG unit can be reconnected to the utility.

III.DISTRIBUTED GENERATION

Distributed generation is any small-scale electrical power generation technology that provides electric power at or near the load site; it is either interconnected to the distribution system or directly to the customer's facilities or both. DG technologies include small Combustion Turbine Generators (including micro turbines), Internal Combustion Reciprocating Engines and Generators, Photovoltaic panels, and Fuel cells. Other technologies including solar thermal conversion, Stirling engines, and Biomass conversion are considered DG. DG has much potential to improve distribution system performance. The use of dg strongly contributes to a clean, reliable and cost effective energy for future. Distributed generation may also be referred to as "Dispersed generation", "Embedded generation" or "Decentralized generation". Some of the technical issues are Islanding of DG, Voltage regulation, Protection and Stability of the network.

- Distribution system with multiple DG's
Distributed or dispersed generation may be defined as generating resources other than central generating stations that is placed close to load being served, usually at customer site. It serves as an alternative to or enhancement of the traditional electric power system. The commonly used distributed resources are wind power, photo voltaic, hydro power. The figure shows the single line diagram of the distribution system with multiple DGs.

IV.MATLAB SIMULATION

The performance of the proposed system for the Active Islanding Detection Technique is validated by MATLAB Simulink Software. Figure shows the simulated diagram of the system. Here sources are connected in the Secondary sides works as a DGs¹ and DGs².

This system was tested under following Values:

- 1) Switching frequency of the sources and DGs: 50 Hz;
- 2) Output frequency of sources and DGs: 50 Hz;
- 3) Switching time of Circuit breaker in Primary and Secondary side: 0.001s
- 4) Length of PI section line in Primary and Secondary side: 30 KM
- 5) Value of loads connected in the circuit:
Vrms: 25kv Active Power: 15mw
QL: 3e6 Qc: 0

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Vol. 7, Issue 3, March 2018

- 6) Source used in Primary side:
Vrms: 120kv Short Circuit Level: 1000mv
Base Voltage: 120e3 X/R ratio: 1.1
- 7) Source used in Secondary side: For both DGs
Vrms:25kv Short Circuit Level: 10mv
Base Voltage:120e3 X/R ratio: 1.1

Below Figure shows the Simulation diagram using MATLAB.
This system works under Four Conditions:

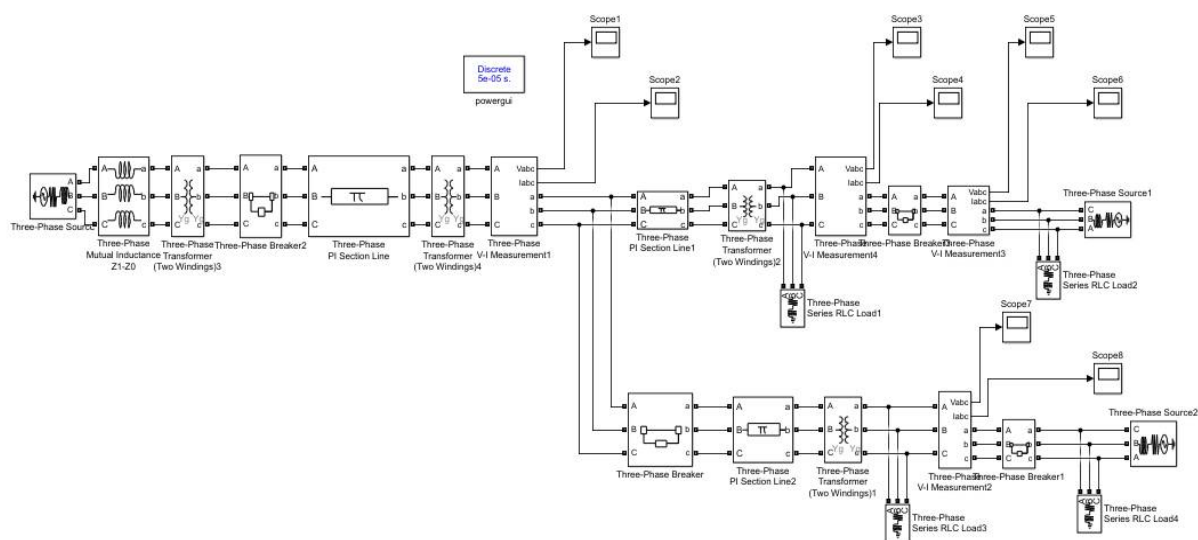


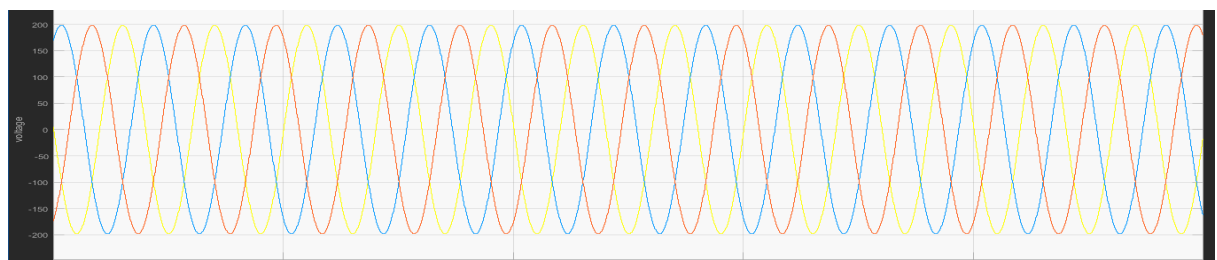
Fig 2: - Simulation Fig for Conditions

1) Condition 1: Normal Condition

Both sides three phase circuit breaker are in closed conditions. That is the **normal condition**. So the voltage & current waveforms found at any DG end is purely sinusoidal. Below figure 3 shows the waveform of Voltage and Current.

Results: For Condition 1

Voltage:



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Vol. 7, Issue 3, March 2018

Current:

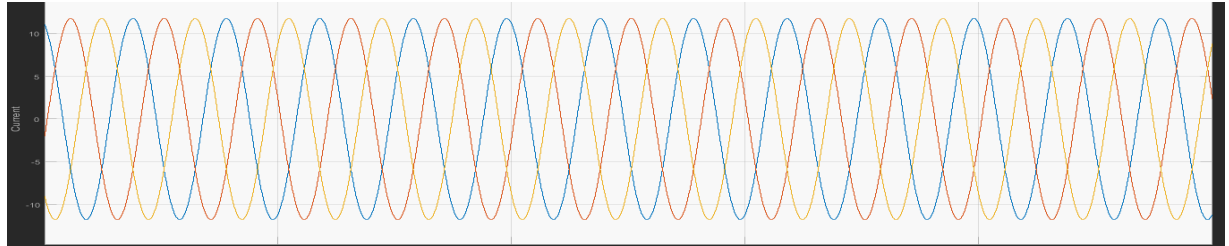


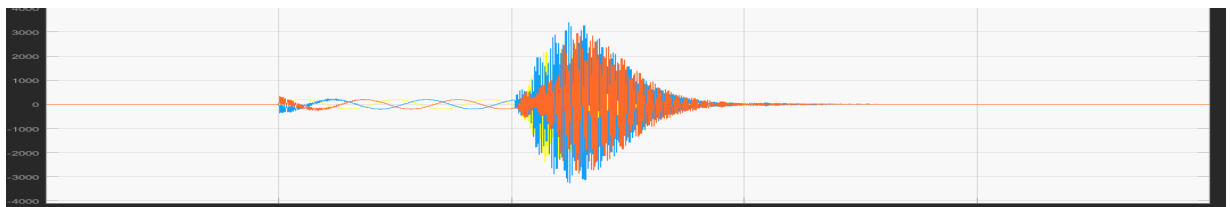
Fig 3:- Waveform of Voltage and Current.

2) Condition 2: **Islanding Condition**

Three phase circuit breaker is initially close and is opened with transition time 1.8 to 1.85. Three phase circuit breaker 1 is permanently open. As after switching off the three phase breaker whole part of the distribution system is isolated from the remainder part of the power system. So this is the **islanding condition**. Below figure 4 shows the waveform of Voltage and Current.

Result: For Condition 2

Voltage:



Current:

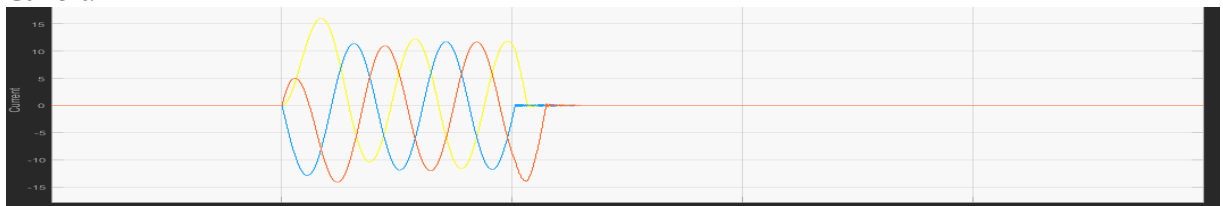


Fig 4:- Waveform of Voltage and Current for Condition 2.

3) Condition 3: **DG Line Trip Condition**

Three phase circuit breaker1 is permanently closed. Three phase breaker2, breaker3 & breaker4 is initially closed and is opened with transition time 1.8 to 1.85. As another DG is there in the line where three phase breaker1 is connected. This is the **DG line trip condition**. Below figure 5 shows the waveform of Voltage and Current.

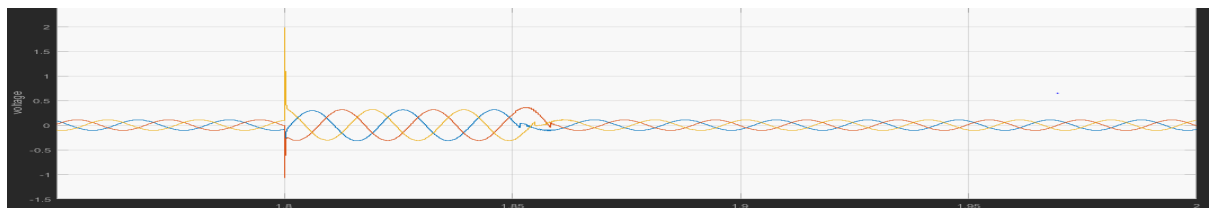
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Vol. 7, Issue 3, March 2018

Result: For Condition 3
Voltage:



Current:

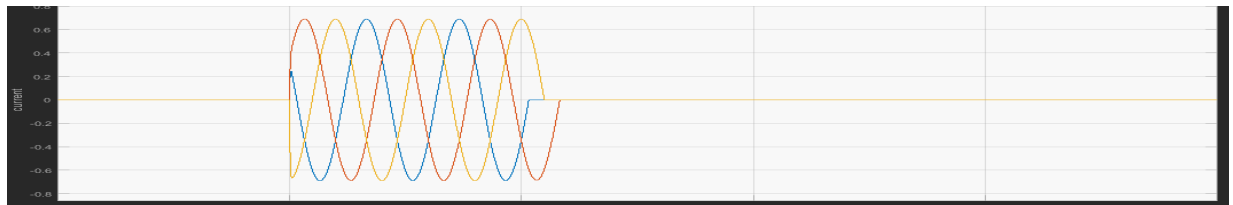
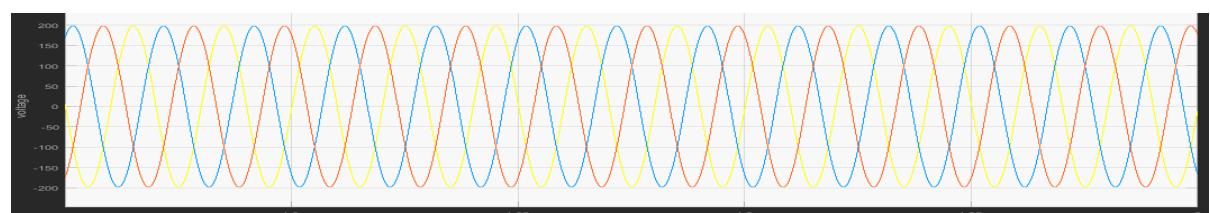


Fig 5:- Waveform of Voltage and Current for Condition 3.

4) Condition 4: Suddenly Load Change Condition

This is the sudden **load change condition**. Where suddenly load is changed up to 50%. Below figure 6 shows the waveform of Voltage and Current.

Result: For Condition 4
Voltage:



Current:

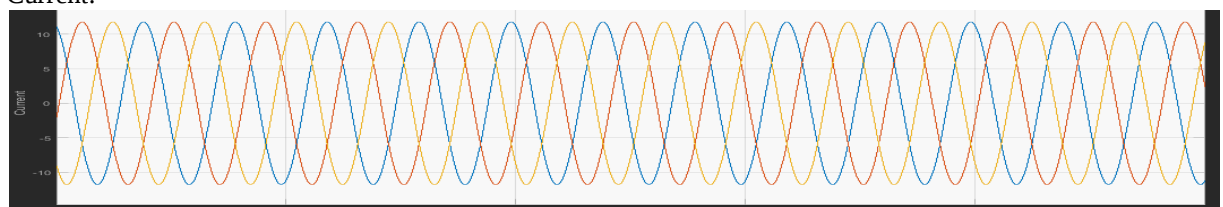


Fig 6:- Waveform of Voltage and Current for Condition 4.

V. CONCLUSION

The overview of several possible islanding detection methods suitable for DGs grid-connected system have been discussed and analysed. From above we can conclude that improves the reliability of the power system, reduces the outage costs, Increase the revenue of the D.G owners. Hence, careful selection has to be made based on the

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Vol. 7, Issue 3, March 2018

understanding of the actual history of islanding probability occurrence in a particular system. This is to ensure that the control system is reliable as well as achieving minimal compromising between cost, system quality and safety risks. In fact, the choice of active-islanding methods is dependent on national electrical rules and regulations, because every country has its own guidelines of DG interconnection requirements.

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