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Active Islanding Detection Technique Used In PV Grid System

Manisha G. Pemdarn¹, Dr. Nilesh Bodhne², Prof. Kiran M. Kimmatkar³

Students of Department of Electrical Engineering Vidarbha Institute of Technology, Nagpur, India¹

Professor Department of Electrical Engineering Vidarbha Institute of Technology, Nagpur, India^{2,3}

ABSTRACT: Photovoltaic (PV) system is one of the popular choices among the non-conventional energy sources & it has too many advantages over the other energy production system. Specifically, it provides a free and abundant supply of electric energy. The issue of islanding in grid-tied PV systems remains a great challenge to fulfill the required guaranteed security of the PV system technique, drives load equipment & the prompt and reliable power supply. Due to islanding, the power supply was interrupted from load and unwanted hazardous conditions may occur for the connected load (drive system in industries) and PV system equipment. In industries this type of fault and interruption is uneconomical. This project aims at providing a study of various IDM's used for grid-tied PV system & simulation analysis of the drive load parameters when islanding condition occurs in the grid-tied PV system and simulate active IDM on PV grid-tied system to detect it which permits us to protect the system. The proposed system will be tested and simulated with the help of MATLAB simulation software.

KEYWORDS: IDM, PV, Grid, Drive Load

I. INTRODUCTION

The past few years have witnessed the PV system being increasingly contributing to energy production all over the world. The integration of new technologies into the actual power grids turns into smart grids. Capable of responding to different changes and requirements for the long term. Those grid-tied PV systems must be essential to detect any harmful faults, islanding, and other types of critical faults to protect the system & load side equipment and very much important to ensure the safety of the grid maintenance personnel. Islanding is one of the major faulty conditions that occur due to various reasons in PV grid-tied systems. This can be intentional or unintentional and create hazardous conditions for the system. This project works on the detection of both intentional or unintentional islanding conditions and protects drive load, equipment from hazardous faulty conditions. According to IEEE standards, the islanding detection methods have to detect islanding fault in PV grid-tied system to ensure the safety of load and PV system equipment. This project consists of two parts. The first part is the study of various islanding detection methods used or proposed for PV grid-tied system to detect islanding faults. After a detailed analysis of all methods, simulation of drive load parameter connected in PV grid-tied system for healthy or before faulty condition done on MATLAB Simulink software. After that simulation of drive load connected in PV grid-connected system when islanding condition occurs in the system and get results of both healthy and islanded system. The second part of this project is to simulate drive load connected in PV grid-tied system with active islanding detection method and get results of drive load parameter in islanded condition with active islanding detection method. After that, the analysis

of simulation results of the healthy system, islanded system, islanded system with active islanding detection method was implemented.

II. PROPOSED SYSTEM

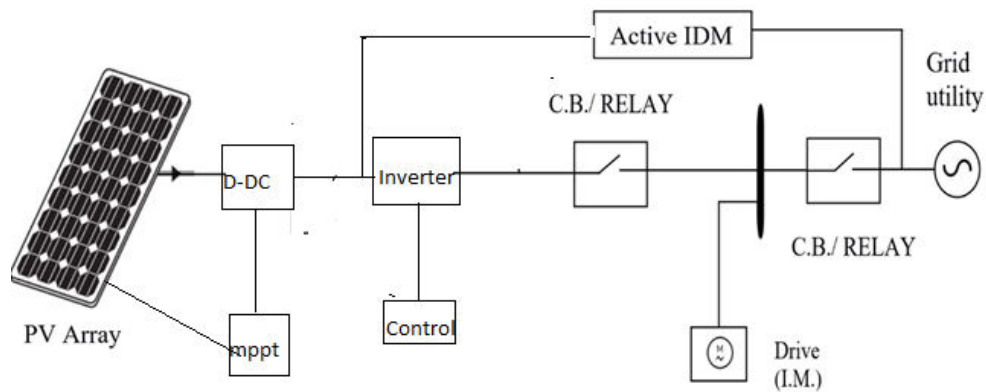


Fig 1 Proposed System

A block diagram broadly describing the elements of Active Islanding Detection Technique in PV Grid-Tied System is shown in Fig. 1. It consists of pv source , DC DC converter with MPPT and inverter. Power generated from solar panel send to grid as well as drive load and in case of non availability of solar energy motor drive run from grid supply. The PVA inverter is connected with breaker operated with islanding detection algorithm .

III. ISLANDING DETECTION ALGORITHM

The flowchart of the proposed islanding detection algorithm is presented in Fig. 2. It starts by monitoring the phase voltage at the PCC and measuring the instantaneous Qload. The reactive power control strategy for the DG plays a pivotal role in the algorithm. The value of the reactive power reference for the DG depends on the PCC voltage to force the frequency to deviate during islanding or to regulate the PCC voltage in grid-connected mode. If either the frequency exceeds the OFP/UFP threshold limits or the PCC voltage goes across the OVP/UVP threshold values, the islanding will be detected. Moreover, in order to ride through the grid disturbances, loose antiislanding voltage/frequency trip settings are recommended [21]. Accordingly, the OVP/UVP and OFP/UFP methods will suffer much larger NDZs. However, the proposed strategy can realize the islanding detection effectively and rapidly with the zero NDZ property.

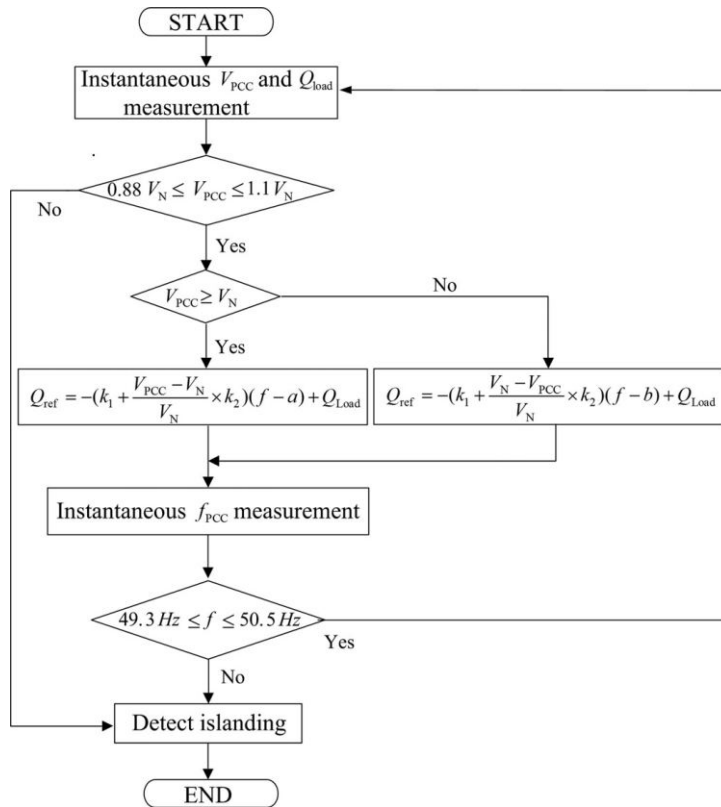


Fig. 2. Flowchart of the proposed algorithm.

IV. SIMULATION OF PROPOSED SYSTEM

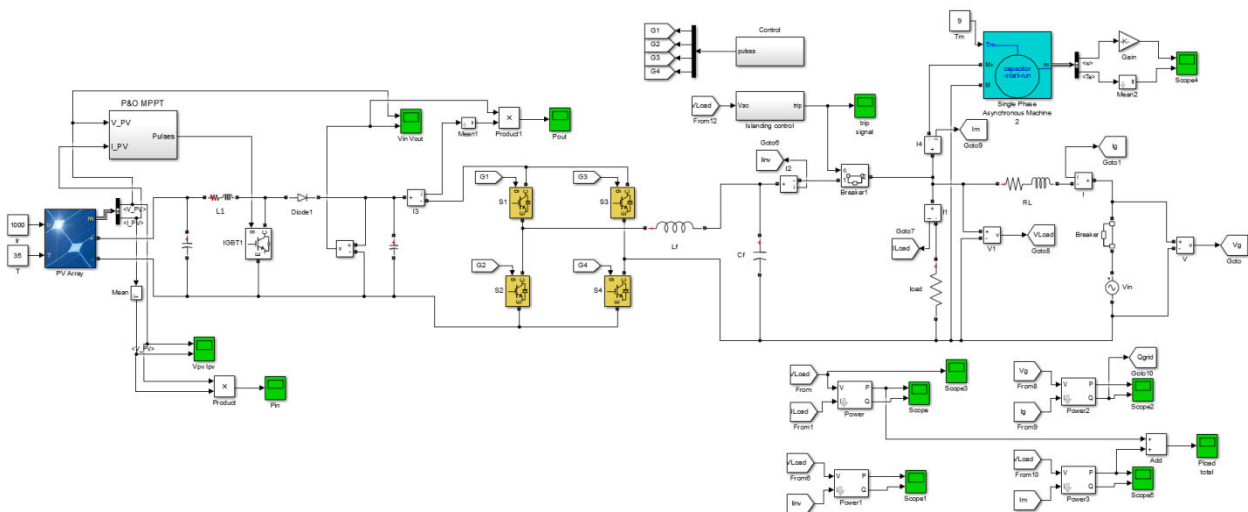


Fig 3. : Modeling of test system

The above is the modeling of the proposed system with PVA grid connection. The PVA inverter is connected with breaker operated with islanding detection algorithm. The inverter is controlled by feedback synchronization controller as shown below.

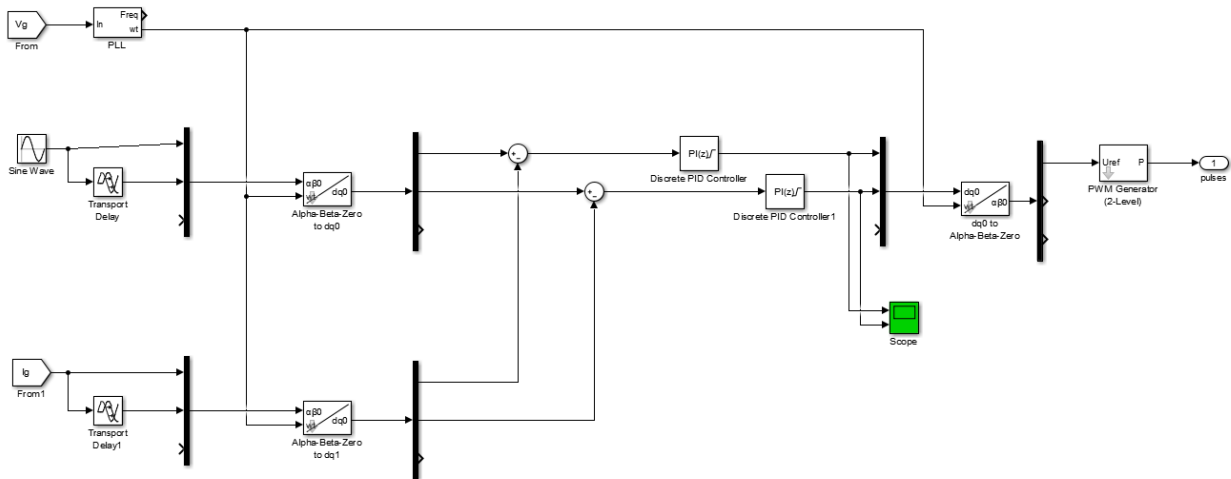


Fig.4 : Inverter controller

V. RESULT

The PVA characteristics for the given rating is shown below.

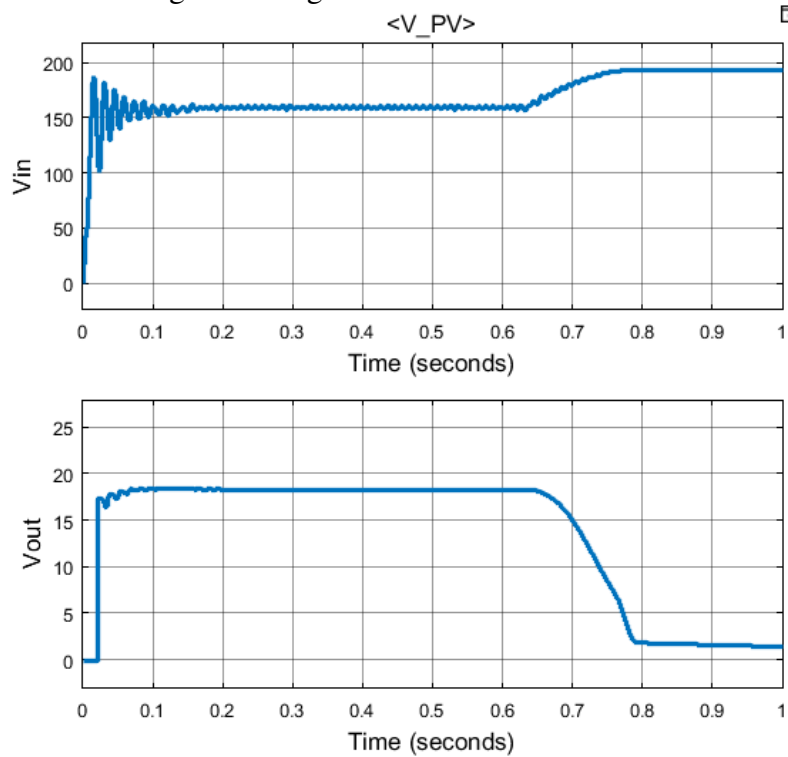


Fig.5 : PVA characteristics



The total power generated by PVA module is shown below.

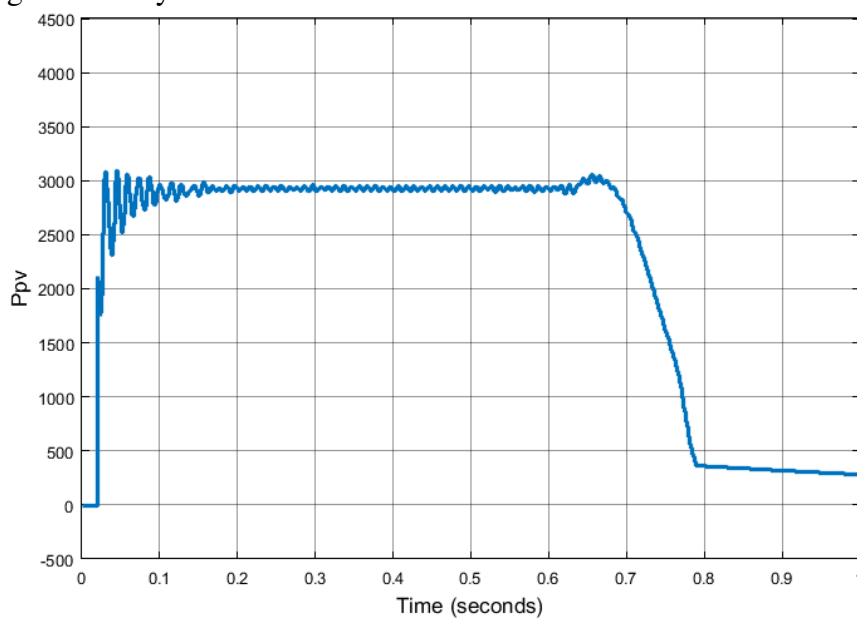


Fig.6 : PVA power

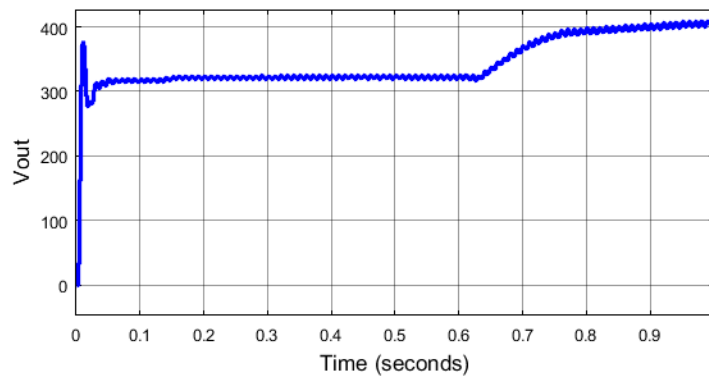
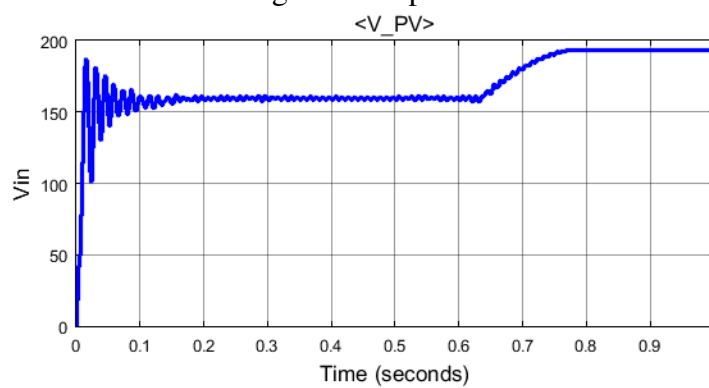


Fig.7 : Input and output power of booster converter

The input voltage and output voltage of the DC-DC booster converter is shown above which is 150V to 300V boosting. The below is the output power of the DC-DC booster converter.

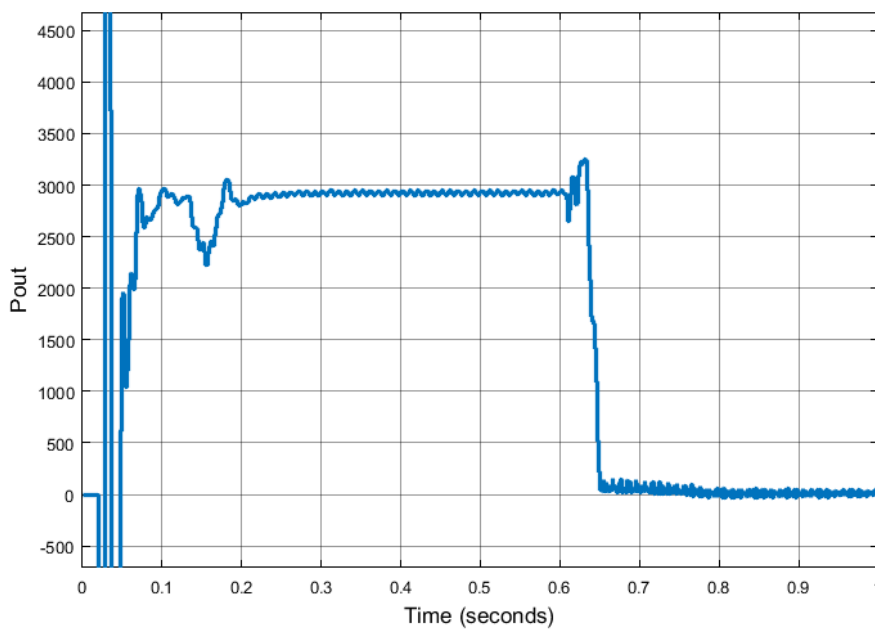


Fig.8 : Output power of booster converter

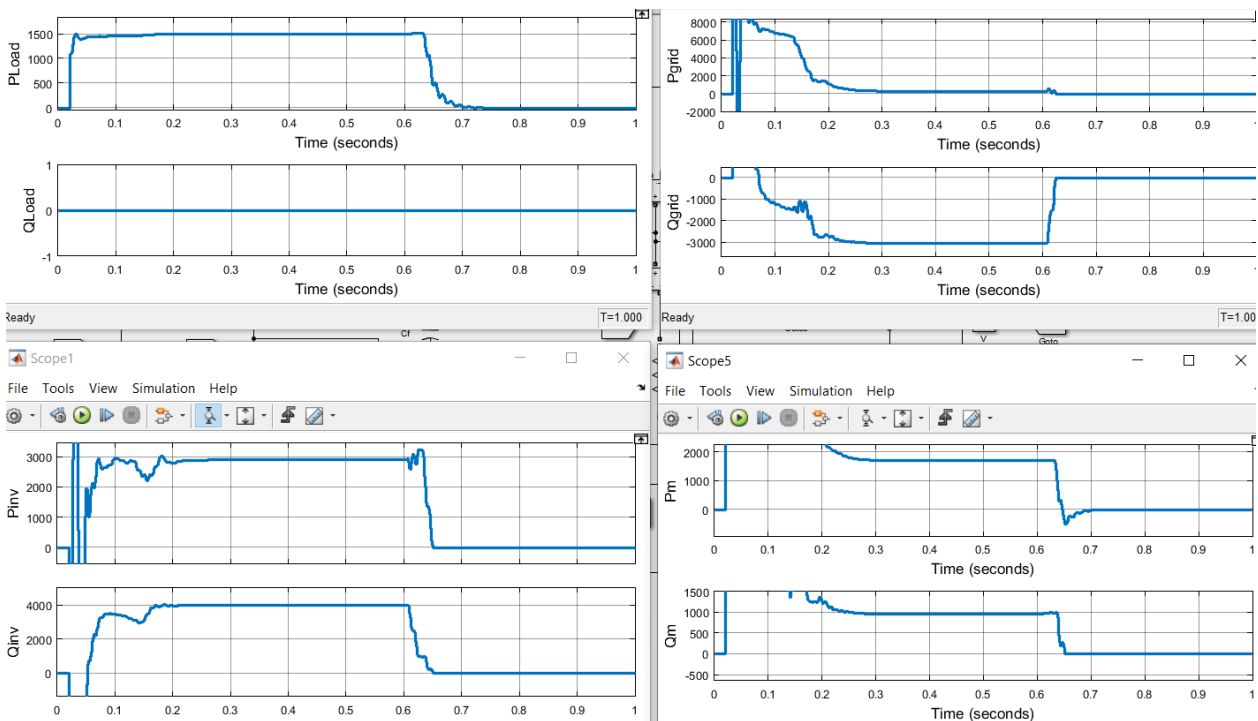


Fig.9 : All modules active and reactive powers

All above are the active and reactive powers of the source and load modules. The total power from the PVA is shared to the static load and dynamic IM load. The below are the characteristics of the IM for the given mechanical torque.

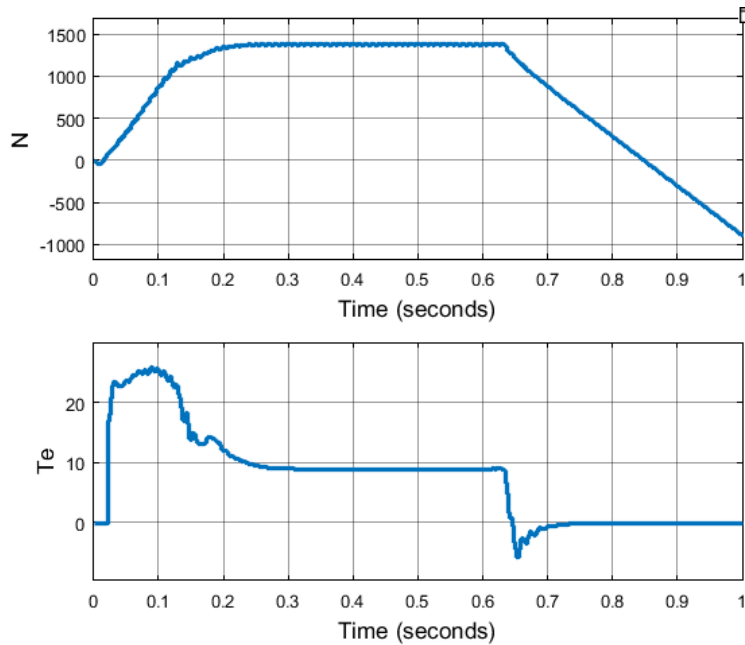


Fig.10 : IM characteristics

The speed is dropped at 0.65sec as the machine is disconnected from grid and PVA module. Therefore the torque is dropped to zero. The below is the islanding detection algorithm modeling with Voltage magnitude, frequency and reactive power measurement.

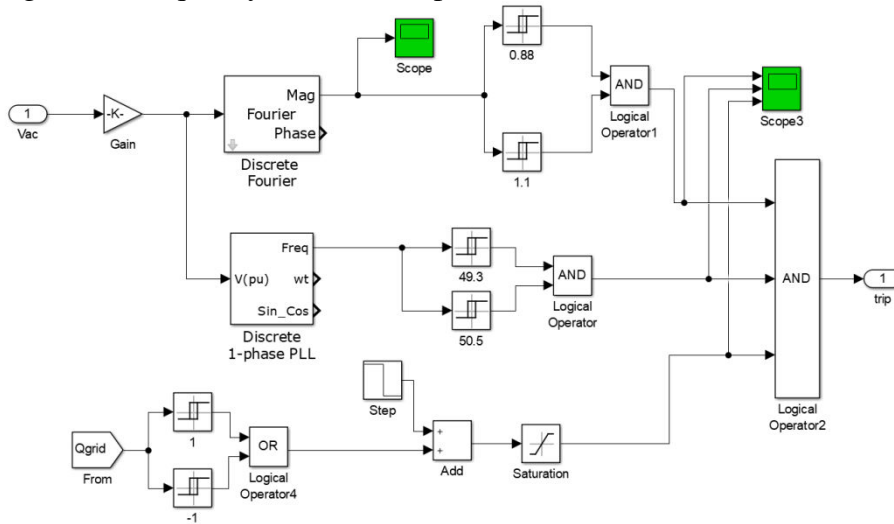


Fig. 11: Islanding detection algorithm

For the grid disconnection the trip signal generated by the islanding detection algorithm is shown below.

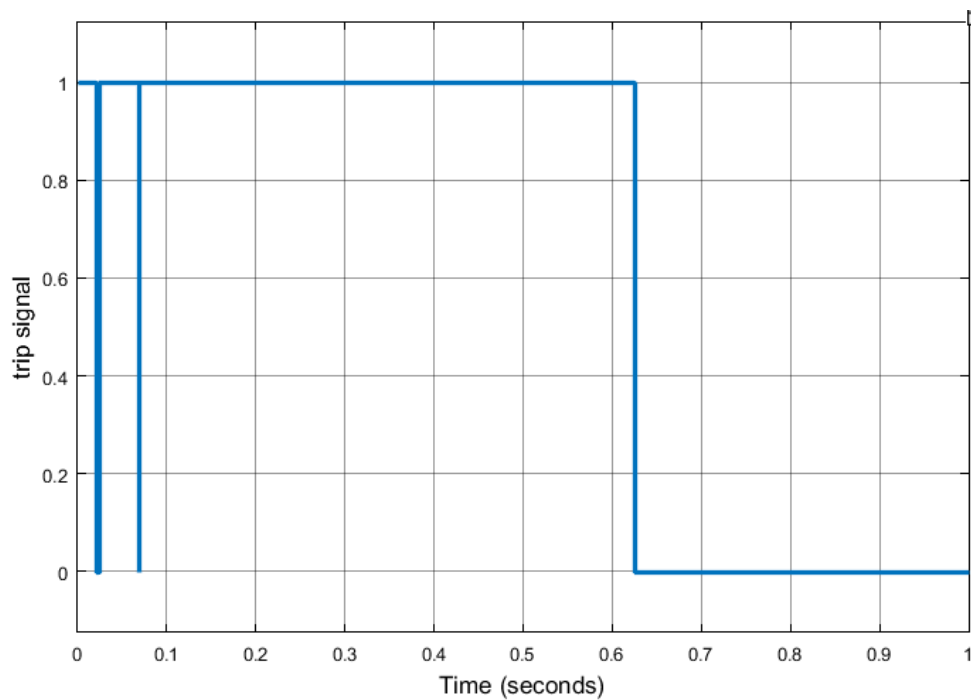


Fig12. : Trip signal of circuit breaker

VI. CONCLUSION

The inverter-based DG can generate both active and reactive power simultaneously under constant power control. For the DG of this kind, this paper analyzes the relationship between the active/reactive power mismatch and frequency deviation respectively during islanding. This paper also presents an innovative islanding detection algorithm for the DG based on reactive power control. In this algorithm, the large voltage deviation due to the sufficient active power mismatch is utilized to detect islanding rapidly according to the OVP/UVF method. To eliminate the NDZ caused by the active power mismatch and detect islanding rapidly, a reactive power control strategy for the DG is proposed to force the frequency to deviate outside the OFP/UFV limits during islanding. Wherever an islanding condition occurs between 49.3 and 50.5 Hz, there will be the reactive power mismatch according to the strategy. With the frequency changing, the mismatch becomes sufficient to drive the frequency to deviate outside the thresholds eventually. Therefore, the OFP/UFV method has the zero NDZ property for the DG equipped with the proposed strategy. Moreover, the reactive power reference for the DG depends on the PCC voltage value that is determined by the active power mismatch during islanding. The consistency of the frequency variation trends caused by both active and reactive power mismatches is guaranteed to accelerate the islanding detection speed. Simulation results verify that the proposed algorithm can detect islanding rapidly. By introducing the voltage deviation into the strategy, the DG can also dynamically improve the PCC voltage profile especially for the grid with high X_g/R_g lines during normal operation. The islanding detection time is further shortened as well because of the larger reactive power mismatch. Furthermore, the proposed islanding detection algorithm also performs effectively for load imbalance conditions as well as for the system with multiple DGs.



REFERENCES

- [1] Fadila Barkat, Ali Cheknane, Josep M. Guerrero, Abderezak Lashab, Marcel Istrate, Ioan Viorel Banu, "A Hybrid Islanding Detection Technique for Single-Phase Grid-Connected Photovoltaic Multi-Inverter Systems." IET renewable power generation, January 2021, DOI: 10.1049/iet-rpg.2019.1183.
- [2] Safdar Raza, Tauheed ur Rahman, Mazhar Saeed, Shahzad Jameel, "performance analysis of power system parameters for islanding detection using mathematical morphology." Ain Shams Engineering Journal, vol. 12, 2021.
- [3] Mahesh Chapai, Braj Kishor Shah, Ishwor Kafle, Ujjwal Adhikari, Dr. Basant Kumar Gautam, "study of technical parameters in grid-connected PV system." IRJET vol. 07, issue 02, Feb. 2020.
- [4] Pritee S. Gotekar, S. P. Muley, D. P.Kothari, "A single phase grid connected PV system working in different modes" Engineering, Technology & Applied science research, vol. 10, no. 5, 2020, 6374-6379.
- [5] Min-Sung Kim, Raza Haider, Gyu-Jung Cho, Chul-Hwan Kim, Chung-Yuen Won, Jong-Seo Chai, "Comprehensive review of islanding detection method for distributed generation system." Energies 2019, 12, 837, doi:10.3390.
- [6] Kirti R. Waghare, N. R. Bhasme, "Islanding Detection of Distributed Generation In The Presence Of Fault Events With Critical Load And Non-Critical Load" IJEAT October 2019, vol. 9, issue 1.
- [7] Ahmed G. Abokhalil, Ahmed Bilal Awan, Abdel-Rahman Al-Qawasmi, "Comparative study of passive and active islanding detection methods for PV grid-connected system." in sustainability 2018 journal, 10, 1798; doi:10.3390/su10061798.
- [8] Fuwen Yang, Nan Xia, Qing-Long Han, "event-based networked islanding detection for distributed solar PV generation system." IEEE transaction on industrial informatics, vol. 13, no. 1, Feb. 2017.
- [9] Ammu SUSAN sabu, Sindhura Rose Thomas, Lekshmi K R, Anju James, "Passive antiislanding protection for grid connected solar photovoltaic power plant: A case study" IJERT ISSN:2278-0181, vol. 4, issue 04, April-2015.
- [10] Rohit Varier, Narayan M. Pindoriya, "A novel active anti-islanding protection scheme for grid-interactive roof-top solar PV system" IEEE 2014, 978-1-4799-5141-3/14. 11) IEEE Std. 929-2000: "IEEE recommended practice for utility interface of photovoltaic (PV) system", 2000



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