ISLANDING DETECTION TECHNIQUE FOR INVERTER BASED DISTRIBUTED GENERATOR USING REACTIVE POWER DISTURBANCES

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Abstract— In this paper, an islanding recognition strategy for inverter-based distributed generators (DGs) is presented, which is based on irritating reactive power yield. Two sets of disturbances are designed in this strategy, which have distinctive amplitudes and length time. The first set of reactive power disturbance (FSORPD) is occasional with small amplitudes to break the reactive power adjust amid islanding, whereas the greatness of the second set of reactive power disturbance (SSORPD) is sufficient to constrain the recurrence to stray outside its threshold limits. Considering all the possible recurrence variety characteristics with the FSORPD in the wake of islanding, three criterions are designed for switching the disturbance from the FSORPD to the SSORPD. Since DGs situated at various positions have the same recurrence variety characteristics, the SSORPDs can be included distinctive DGs at the same time without the need of correspondence. In this manner, synchronization of the SSORPDs can be ensured for the system with different DGs and the technique can distinguish islanding with a zero no detection zone property. In addition, the strategy can be connected to the DG either working at solidarity power factor or supplying reactive power as well for its neighbourhood load.

I. INTRODUCTION

T HE inverter-based distributed generator (DG) uses renewable energy (photovoltaic, wind power, fuel cell, and micro turbine, etc.) to supply power for the network and local load [1], [2]. It is being widely applied to protect environment and make the power industry development sustainable. In order to ensure the safe operation of both the network and the DG, the DG has to be equipped with islanding detection function according to IEEE Std. 929-2000 and IEEE Std. 1547-2003 [3], [4].

Islanding is a condition in which a portion of the utility system that contains both the DG and load continues operating while this portion is electrically separated from the main utility. Unintentional islanding can result in power quality problems, serious equipment damage, and even safety hazards to utility operation personnel [5], [6]. Therefore, the DG has to detect islanding effectively in this case and disconnect itself from the network as soon as possible to prevent the damages mentioned earlier. According to IEEE Std. 929-2000 and IEEE Std. 1547- 2003, a maximum delay of 2 s is required for the detection of an islanding and a generic system for islanding detection study is recommended as well, where the distributed network, the RLC load and the DG are connected at the point of common coupling (PCC). Generally, islanding detection methods can be classified into following three categories: 1) communication-based methods; 2) passive methods; and 3) active methods. Communication based methods do no harm to the power quality of the power system and have no non detection zones (NDZs) in the theory. However, the cost is much high because of the need of communication infrastructure and the operations are more complex as well [7]. In addition, the effectiveness cannot be guaranteed with the risk of communication breakdown [8]. Therefore, passive and active methods have been well developed. Passive methods determine the islanding condition by measuring system parameters such as the magnitude of the voltage at the PCC, the PCC voltage frequency, and phase jump [9]. Accordingly, over/under frequency protection (OFP/UFP), over/under voltage protection (OVP/UVP) and phase jump detection (PJD) are the most widely used passive islanding detection methods. These passive methods are easy to implement and do no harm to the power quality, but they may fail to detect islanding when the local load's power consumption closely matches the DG's power output [10], [11]. In order to reduce or eliminate the NDZ, active methods rely on intentionally injecting disturbances, negative sequence components or harmonics into some DG parameters to identify whether islanding has occurred [12]–[14]. The active frequency drift [15], slip-mode frequency shift [16], and Sandia frequency shift [17] methods are three classical active methods by creating a continuous trend to change the frequency during islanding. Though active methods suffer smaller NDZs, they sacrifice power quality and reliability of the power system during normal operation. Moreover, some active methods have difficulty in maintaining synchronization of the intentional disturbances. Therefore, they may not work owing to the averaging effect when applied in multiple-DG operation [18], [19].

II.EXISTING SYSTEMS

As of late, plans in light of reactive power control to identify islanding are attractive and a few strategies have been proposed Keeping in mind the end goal to identify islanding, the essential component of these techniques is to make the reactive power jumble, which can drive the recurrence of the PCC voltage to change amid islanding. This can be accomplished just by updating reactive power reference for the DG or infusing reactive power/current unsettling influence, which can be effectively actualized. In addition, the NDZ can be lessened or even wiped out with legitimate plan. The thought in this paper is enlivened by the investigations in [22] and [23]. An islanding detection strategy in light of discontinuous reciprocal reactive power variety (RPV) was proposed in [22]. The variety sufficiency was 5% of the DG's active power yield. The recurrence was inevitably compelled to go amiss outside the ordinary range amid islanding because of the reactive power variety. Contrasted and the strategy in [22], the technique proposed in [23] was enhanced by just yielding one-sided RPV in every variety period and further lessening the variety in view of the heap's reverberation recurrence detection. In any case, the two techniques endured a significant issue, which was that the synchronization of the RPVs couldn't be ensured when the strategies were connected to various DGs. Along these lines, the adequacy of the strategies was diminished and they may neglect to distinguish islanding for the framework with numerous DGs. Then again, the DG was likewise investigated to create both active and reactive power at the same time for power factor change and in addition the voltage control [25],The islanding detection strategies proposed in [20] and [25] were intended for the DG of this kind. In any case, the techniques proposed in [22] and [23] were fitting just for the DG working at unity power factor.

IV.PROPOSED SYSTEM

For the DG producing both active and reactive power, the connection between the reactive power disturbance and the recurrence variety amid islanding is broke down in this paper, which is unique in relation to that for the DG working at unity power factor. In addition, this paper shows an inventive islanding detection technique, which depends on irritating reactive power yield too. Two arrangements of disturbances are designed, which have distinctive amplitudes and term time. The primary arrangement of reactive power disturbance (FSORPD) is intermittent with little amplitudes, though the size of the second arrangement of reactive power disturbance (SSORPD) is adequate to constrain the recurrence to veer off outside its edge limits amid islanding. Considering all the conceivable recurrence variety qualities with the FSORPD in the wake of islanding, three criterions are intended for changing the disturbance from the FSORPD to the SSORPD. Since DGs situated at various positions have a similar recurrence variety qualities, the SSORPDs on various DGs can be enacted in the meantime without the need of correspondence. In this way, the proposed technique has following three recognizing highlights: 1) It can be connected to the DG either working at unity power factor or providing reactive power too for its neighbourhood stack; 2) The irritation of reactive power is additionally decreased amid ordinary activity; 3) Synchronization of the disturbances can be ensured for the framework with different DGs and the strategy can detect islanding with the zero NDZ property.

A.SYSTEM MODELING

As per IEEE Std.929 and IEEE Std.1547, the prescribed test framework for islanding detection think about is appeared in Fig. 1. It comprises of an inverter-based DG, a parallel RLC stack and the network spoke to by a source behind impedance. The activity method of the DG relies upon whether the electrical switch is shut or not. The Inverter-based DG, for example, photovoltaic age and wind power age is typically arranged with the most extreme power point following controller. Since the islanding detection time is short, the yield power can be thought to be consistent amid the detection. In this way, utilizing a steady dc source behind a three-stage inverter, the DG is composed as a consistent power source.

Fig. 2 presents the block diagram of the DG interface control. The phase-locked loop (PLL), the outer power control loop and the inner current control loop are three main parts. According to the instantaneous power theory and the Park transformation, the DG can control the active and reactive power output independently based on the dual close loop control structure in the d-q synchronous reference frame [25].

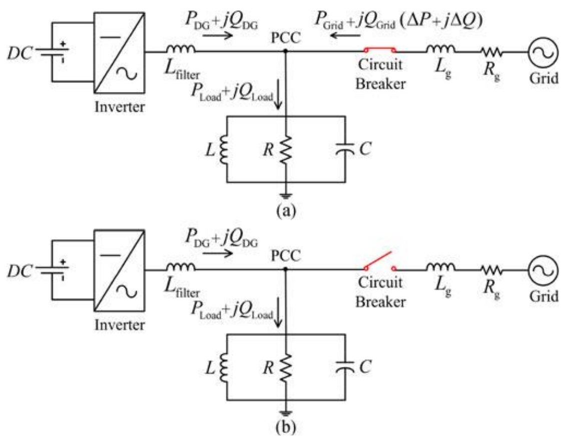

Fig. 1. Test system for islanding detection study (a) Grid-connected operation mode (b) Islanding operation mode.

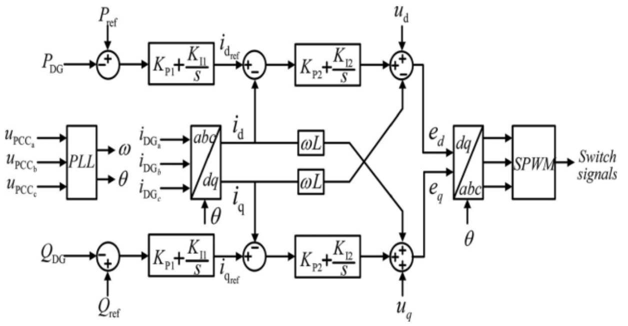

Fig. 2. DG interface control for constant power operation.

B. PROPOSED ISLANDING DETECTION METHOD BASED ON REACTIVE POWER DISTURBANCE

Keeping in mind the end goal to enhance the execution of islanding detection techniques that depend on the reactive power disturbance, following three issues must be comprehended: 1) the strategy must be relevant for both the DG working at unity power factor and that generating reactive power too; 2) the disturbance on the DG is smarter to be diminished however much as could be expected amid ordinary task and it additionally must be adequate to drive the recurrence outside its edge constrains subsequent to islanding; and 3) the synchronization of the disturbances on various DGs must be ensured. As broke down in Section II, the connections among f0 , fi, and Qdis are distinctive for these two sorts of DGs. Thinking about various relationship attributes, the technique proposed in this paper can detect islanding adequately for the two sorts of DGs. Keeping in mind the end goal to tackle the second issue said before, two arrangements of reactive power disturbances, which have distinctive amplitudes and term time, are planned in the proposed technique. The FSORPD is occasional with little amplitudes, while the extent of the SSORPD is adequate to constrain the recurrence to digress outside its edge limits amid islanding. What's more, considering all the conceivable recurrence variety attributes with the FSORPD in the wake of islanding, three criterions are intended for changing the disturbance from the FSORPD to the SSORPD. Since DGs situated at various positions can detect similar recurrence variety qualities, the SSORPDs on various DGs can be synchronously initiated without the need of correspondence. In the accompanying parts, the proposed strategy is presented in detail.

i. FSORPD and Three Criterions for Switching the Disturbance

From the FSORPD to the SSORPD The reactive power disturbance itself can break the reactive power adjust amid islanding, subsequently making the end of the NDZ conceivable. Moreover, the outline of the FSORPD likewise needs to conform to following two standards: 1) lessening disturbance however much as could reasonably be expected amid ordinary activity and 2) framing criterions for beginning the SSORPD in the wake of islanding. Keeping in mind the end goal to meet previously mentioned necessities, the FSORPD is intended to contain two sections whose amplitudes are Qdis1 and 2Qdis1 , individually, and it is included the DG's evaluated reactive power reference occasionally. The estimation of Qdis1 is equivalent to either Qdis11 or Qdis12 , which relies upon the recurrence toward the start of the FSORPD. Qdis1 can be communicated as takes after: condition (14) as appeared at the base of the page where Δfset is a preset positive esteem and f is the momentary recurrence toward the start of the FSORPD. Also, the length time of the initial segment is the same as that of the second part.

$$Q_{\mathrm{dis1}} = \begin{cases} Q_{\mathrm{dis11}} = P_{\mathrm{DG}} Q_f \left(\dfrac{50}{50+\Delta f_{\mathrm{set}}} - \dfrac{50+\Delta f_{\mathrm{set}}}{50} \right), & f \geq 50\,\mathrm{Hz} \\ Q_{\mathrm{dis12}} = P_{\mathrm{DG}} Q_f \left(\dfrac{50}{50-\Delta f_{\mathrm{set}}} - \dfrac{50-\Delta f_{\mathrm{set}}}{50} \right), & f < 50\,\mathrm{Hz} \end{cases}$$

ii. SSORPD and Two Criterions for Islanding Determination

Since DGs situated at various positions have similar recurrence variety qualities, the SSORPDs on various DGs can be enacted in the meantime without the need of correspondence. The SSORPD is intended to have the capacity to constrain the recurrence to go astray outside its edge restricts and decide islanding inevitably. In this way, contrasted and the FSORPD, the SSORPD has bigger adequacy. Additionally, its incentive for the DG working at unity power factor is not the same as that for the DG generating both active and reactive power at the same time.

With respect to the DG working at unity power factor, the abundancy of the SSORPD can be communicated as takes after:

$$Q_{\mathrm{dis2}} = \begin{cases} Q_{\mathrm{dis21}} = P_{\mathrm{DG}} Q_f \left(\dfrac{50}{50+0.6} - \dfrac{50+0.6}{50} \right), & f \geq 50\,\mathrm{Hz} \\ Q_{\mathrm{dis22}} = P_{\mathrm{DG}} Q_f \left(\dfrac{50}{50-0.8} - \dfrac{50-0.8}{50} \right), & f < 50\,\mathrm{Hz}. \end{cases}$$

With respect to the DG generating both active and reactive power all the while, f0 is obscure ahead of time and it can't be ascertained in the wake of islanding. In this way, the SSORPD for the DG of this kind contains two sections, which have a similar length time T1 however unique amplitudes. The plentifulness of the initial segment can be communicated as takes after:

$$Q_{\mathrm{dis2}} = \begin{cases} Q_{\mathrm{dis21}} = P_{\mathrm{DG}} Q_f (50-50.6) \left(\dfrac{50}{50 \cdot 50.6} + \dfrac{1}{50} \right), & f \geq 50\,\mathrm{Hz} \\ Q_{\mathrm{dis22}} = P_{\mathrm{DG}} Q_f (50-49.2) \left(\dfrac{50}{50 \cdot 49.2} + \dfrac{1}{50} \right), & f < 50\,\mathrm{Hz}. \end{cases}$$

TABLE I
CRITERIONS FOR SWITCHING THE DISTURBANCE FROM THE FSORPD TO THE SSORPD

Criterion	Content	Corresponding Condition
First	1) $f > 50.3$ Hz or $f < 49.7$ Hz; 2) its duration time is no less than T_{dur}.	The FSORPDs are synchronous or the nonsynchronization is not serious.
Second	1) The SOAFV is periodic; 2) its cycle time is equal to T_{dis}.	1) The FSORPDs are asynchronous; 2) some FSORPDs overlap with each other.
Third	1) The SOAFV satisfies equation (16); 2) the frequency variation is not zero.	1) The FSORPDs are asynchronous; 2) a certain FSORPD does not overlap with the others.

TABLE II
CRITERIONS FOR ISLANDING DETERMINATION

:rion	Content	Corresponding Condition
	1) $f > 50.3$ Hz or $f < 49.7$ Hz; 2) its duration time is no less than T_{dur}.	The FSORPDs are synchronous or the nonsynchronization is not serious.
ond	1) The SOAFV is periodic; 2) its cycle time is equal to T_{dis}.	1) The FSORPDs are asynchronous; 2) some FSORPDs overlap with each other.
d	1) The SOAFV satisfies equation (16); 2) the frequency variation is not zero.	1) The FSORPDs are asynchronous; 2) a certain FSORPD does not overlap with the oth

iii. Implementation Steps of the Proposed Method

The proposed islanding detection strategy is anything but difficult to actualize. The flowchart of the proposed technique is exhibited in Fig. 11. Initial, two arrangements of reactive power disturbances, three criterions for disturbance exchanging and two criterions for islanding assurance must be designed. Relative parameters are set ahead of time also. For the most part, the FSORPD is included the appraised reactive power reference of the DG. On the off chance that any of three criterions for disturbance exchanging is fulfilled, the SSORPD will replace the FSORPD. At that point, if both of two criterions for islanding detection is met, islanding will be resolved. Something else, the SSORPD will be supplanted by the FSORPD after its term time.

Steady RLC stack is by and large considered as the hardest detectable condition for an islanding detection strategy and it is prescribed in the bland framework to look at the islanding detection strategies' execution. In [31], diverse sorts of burdens were displayed by changing the heap's voltage and recurrence reliance parameters and the execution of the OVP/UVP and OFP/UFP strategies with various load models was dissected. It was discovered that the heap's voltage and recurrence reliance parameters have no impact on the measure of recurrence deviation. In addition, for the steady power stack, since the DG was under consistent power control while islanding happened and there was no voltage reliance, the voltage fallen. Consequently, the islanding can be effortlessly detected for the heap of this kind as per the detached OVP/UVP strategies [32]. Concerning the engine stack, the test brings about [23] demonstrated that lone the detached OFP/UFP technique could understand islanding detection despite the fact that there were no active and reactive power confuses. Likewise, as per (14), (17), and (18), the estimation of Qdis relies upon the DG's active power yield PDG . On the off chance that the estimation of PDG is equivalent to zero subsequent to islanding, the estimation of Qdis will be zero also.

Consequently, the proposed technique can't detect islanding for this condition. In any case, as indicated by (1), the PCC voltage is likewise zero for this situation. Since the voltage crumples, the latent OVP/UVP strategy can undoubtedly detect islanding in this circumstance. Thusly, the proposed technique and the detached OVP/UVP and OFP/UFP strategies can frame the repetition design and this setup can understand islanding detection adequately and dependably for the framework with various types of burdens.

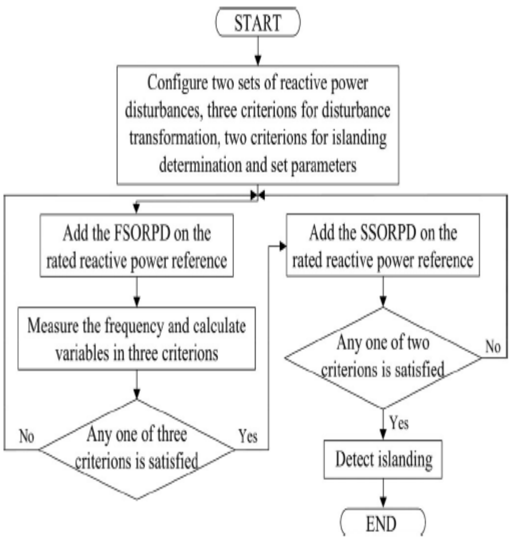

Fig. 3. Flowchart of the proposed islanding detection method

V.RESULTS

a. Simulation Results During Islanding For The DG Generating Active Power .

Below Figures illustrates the PCC frequency and the DG's reactive power output during islanding in each test case of Part A. It can be noted that frequencies deviate outside the threshold limits in all five cases and islanding can be detected with different detection time.

Table III
Load Parameter Setting For Different Test Cases In Part A

Case	R/Ω	L/mH	C/μF	f_0 /Hz
1	0.8	1.0186	9947.2	50
2	0.8	1.0145	9907.6	50.2
3	0.8	1.0105	9868.2	50.4
4	0.8	1.0227	9987.1	49.8
5	0.8	1.0268	10027.4	49.6

Case 1

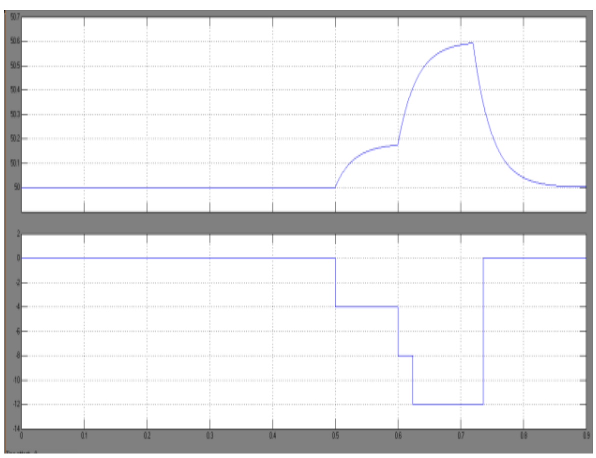

Fig. 4 Simulation results of PCC frequency and the DG's reactive power output

Case 2

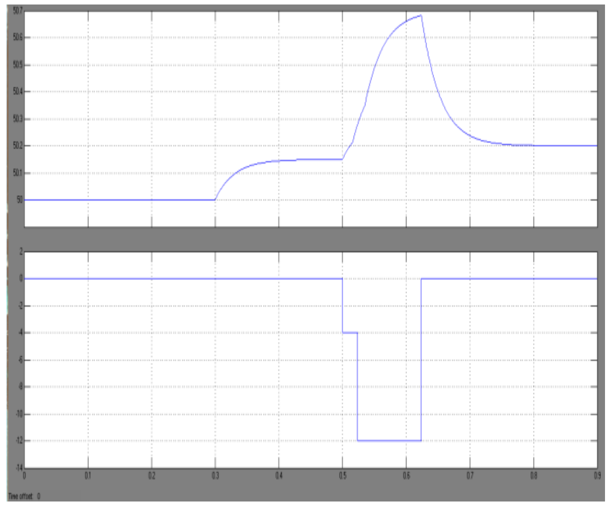

Fig. 5 Simulation results of PCC frequency and the DG's reactive power output

Case 3

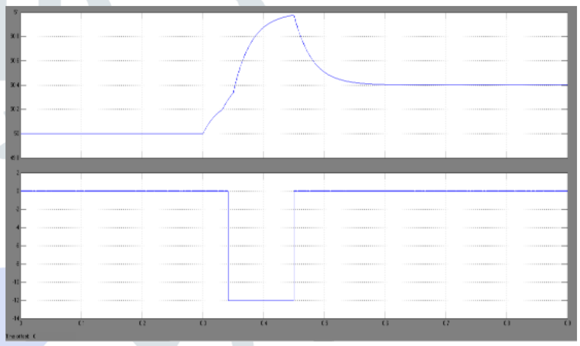

Fig. 6 Simulation results of PCC frequency and the DG's reactive power output

Case 4

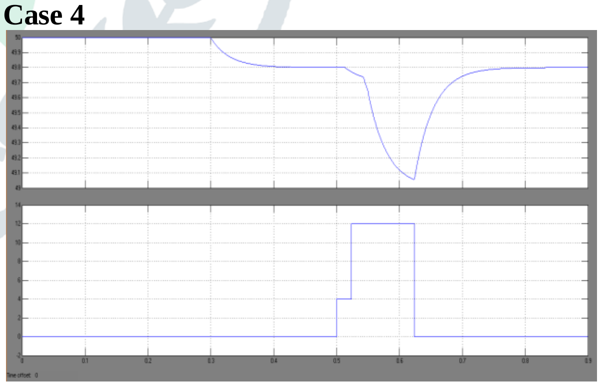

Fig.7 Simulation results of PCC frequency and the DG's reactive power output

Case 5

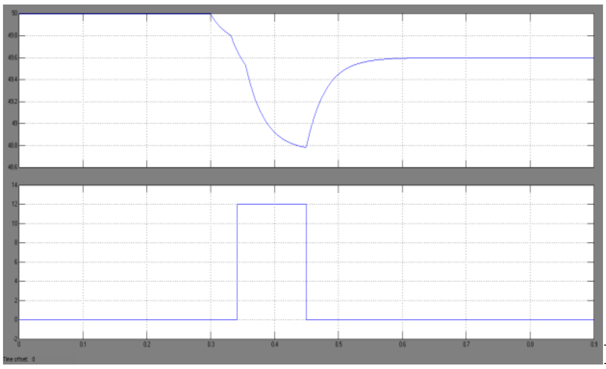

Fig. 8 Simulation results of PCC frequency and the DG's reactive power output

i.Simulation Results for Unbalanced Loads

The performance of the proposed method for unbalanced loads is also examined. Following three conditions are considered:

1) in case A, only the resistance of phase a is set at 97% of its rated value;
2) in case B, only the resistance of phase c is set at 103% of its rated value;
3) in case C, resistances of phase *a* and phase *c* are set at 97% and 103% of the rated value, respectively.

Case A

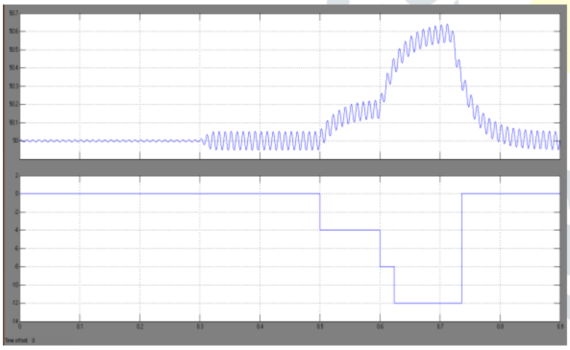

Fig.9 Simulation Result for Unbalanced Loads (a) PCC Frequency (b) The DG's Reactive Power Output

Case B

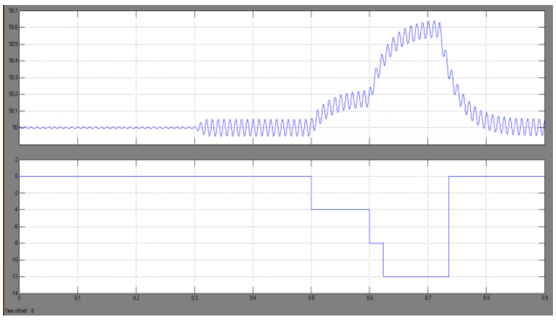

Fig. 10 Simulation Result For Unbalanced Loads (a) PCC Frequency (b)The DG's Reactive Power Output

Case C

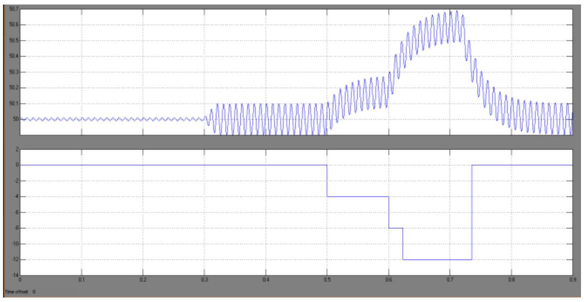

Fig. 11 Simulation Result For Unbalanced Loads (a) PCC Frequency (b)The DG's Reactive Power Output

b. Simulation Results During Islanding For The DG Generating Active And Reactive Power Simultaneously

Below Figures illustrates the PCC frequency and the DG's reactive power output during islanding in each test case of Part A. It canbe noted that frequencies deviate outside the threshold limits in all five cases and islanding can be detected with different detection time.

Table IV
Load Parameter setting For Different Test Cases In Part B

Case	R/Ω	L/mH	C/μF	f_0/Hz	ΔP_{nor}/kW	ΔQ_{nor}/kVar
1	0.8	0.9218	9002.1	55.3	0	0
2	0.7619	0.9218	9002.1	55.3	10	0
3	0.8421	0.9218	9002.1	55.3	−10	0
4	0.8	0.9145	8930.7	55.7	0	8
5	0.8	0.9292	9074.1	54.8	0	−8

Case 1

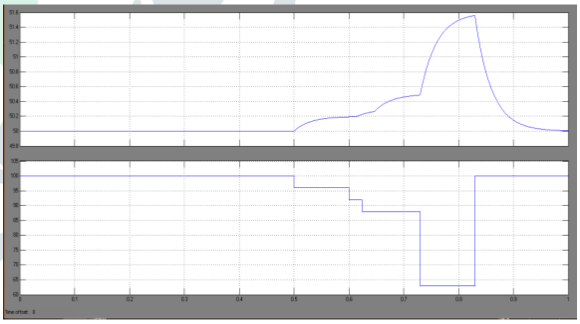

Fig.12 Simulation Result of The PPC Frequency and The DG's Reactive Power Output

Case 2

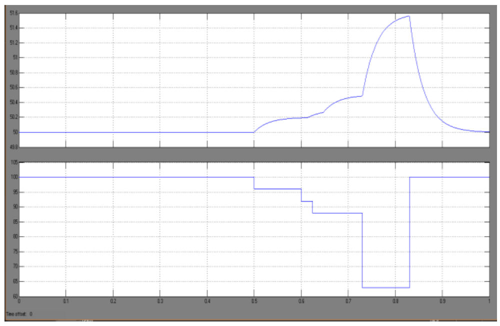

Fig. 13 Simulation Result For Unbalanced Loads (a) PCC Frequency (b)The DG's Reactive Power Output

Case 3

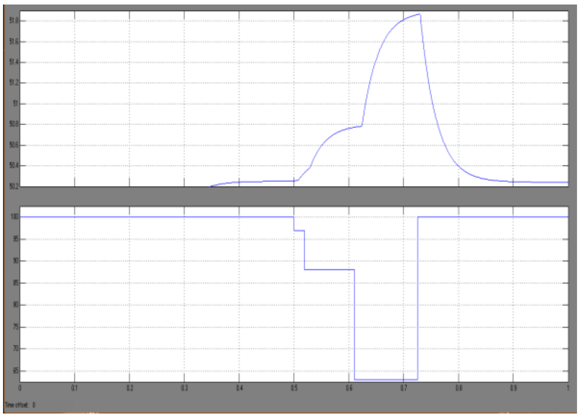

Fig. 14 Simulation Result for Unbalanced Loads (a) PCC Frequency (b) The DG's Reactive Power Output

Case 4

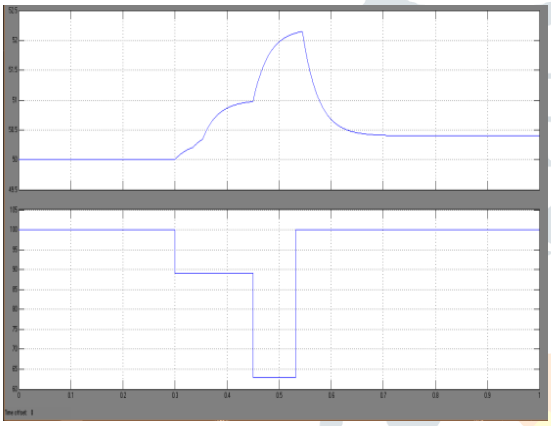

Fig. 15 Simulation Result For Unbalanced Loads (a) PCC Frequency (b)The DG's Reactive Power Output

Case 5

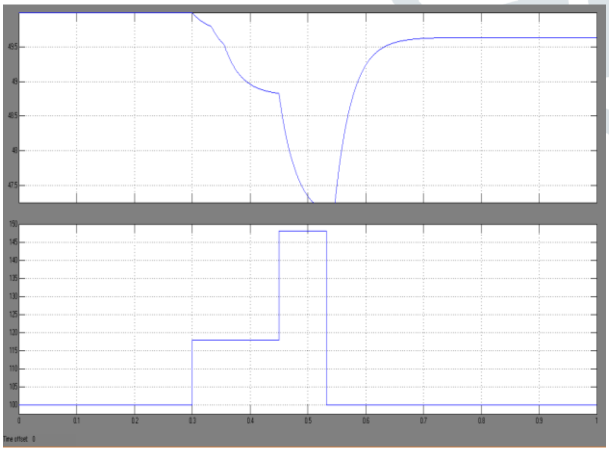

Fig. 16 Simulation Result For Unbalanced Loads (a) PCC Frequency (b) The DG's Reactive Power Output

i. Simulation Results of Unbalanced Loads:

The performance of the proposed method for unbalanced loads is also examined. Following three conditions are considered: 1) in case A, only the resistance of phase a is set at 97% of its rated value;

2) in case B, only the resistance of phase c is set at 103% of its rated value;

3) in case C, resistances of phase *a* and phase *c* are set at 97% and 103% of the rated value, respectively.

Case A

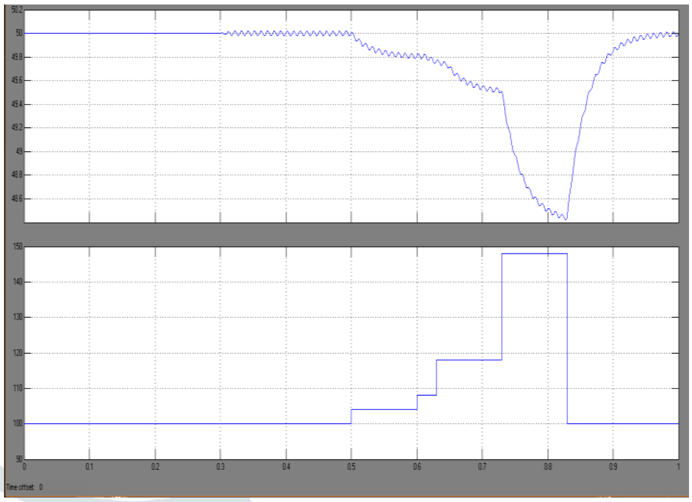

Fig. 17 Simulation Result for Unbalanced Loads of The PPC Frequency and DG's Reactive Power Output

Case B

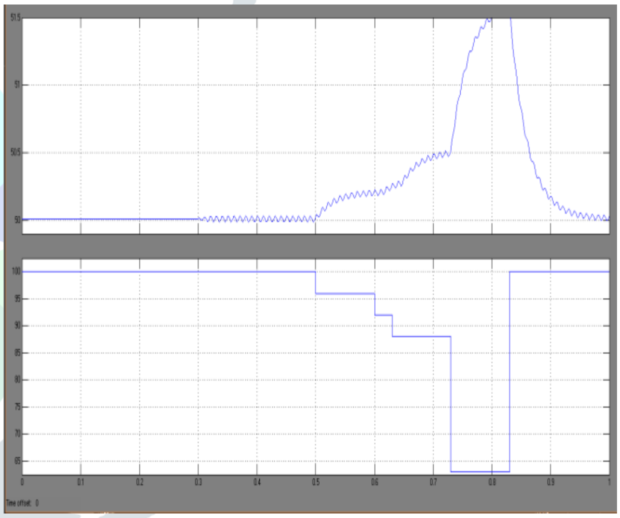

Fig. 18 Simulation Result for Unbalanced Loads of The PPC Frequency and DG's Reactive Power Output

Case C

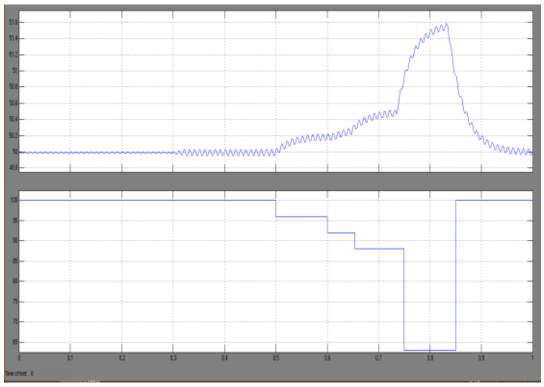

Fig. 19 Simulation Result for Unbalanced Loads of The PPC Frequency and DG's Reactive Power Output

.c. Simulation Results in Scenario A

Considering the possible conditions of these disturbances on both DGs, following three scenarios are designed: 1) in scenario A, the disturbances are added on the rated reactive power references of both DGs simultaneously at $t = 0.5$ s

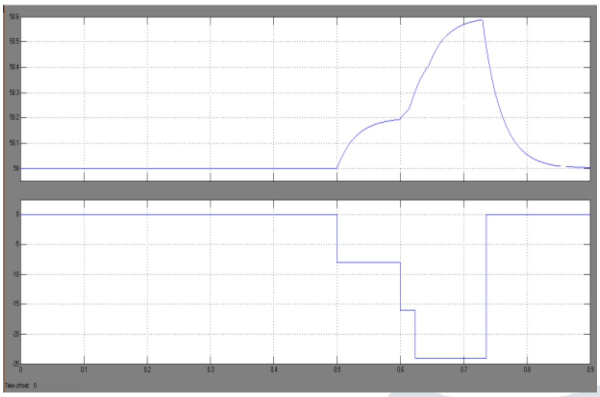

Fig.20 Simulation results of the PCC frequency and separate reactive power output

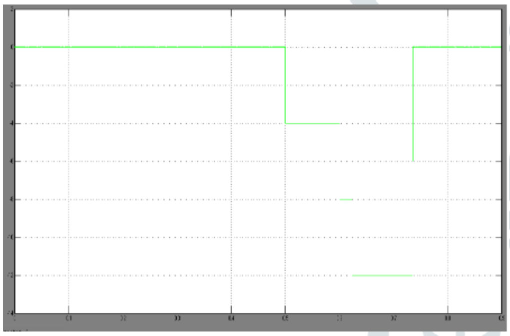

Fig. 21 Simulation results of The DG's total reactive power output

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d. Simulation Results of Scenario B (the lag time is 80 ms)

Iin scenario B, the disturbances are not added at the same time, but they overlap with each other. Two cases are simulated in this scenario and the disturbance on the DG2 lags behind that on the DG1 for 80 and 180 ms, respectively, in these two cases;

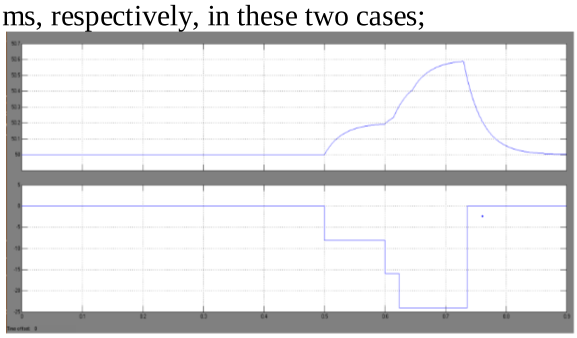

Fig.22 Simulation results of the PCC frequency and separate reactive power

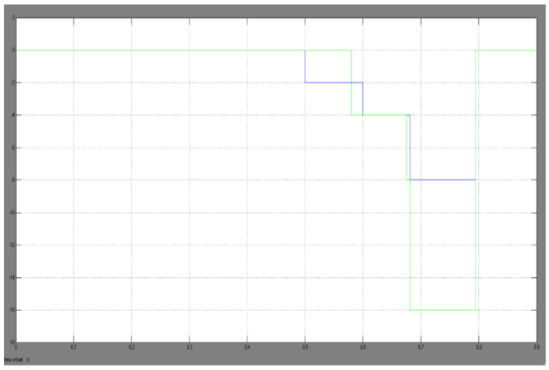

Fig.23 Simulation results of The DG's total reactive power output

e. Simulation Results of Scenario B (the lag time is 180 ms)

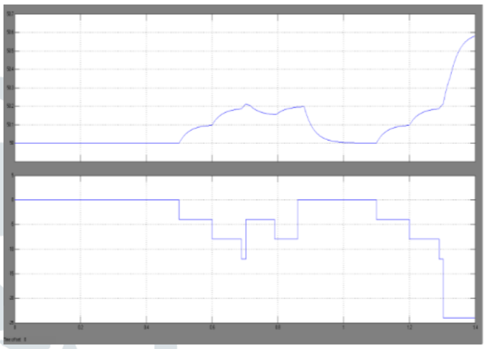

Fig 24 Simulation results of the PCC frequency and separate reactive power output

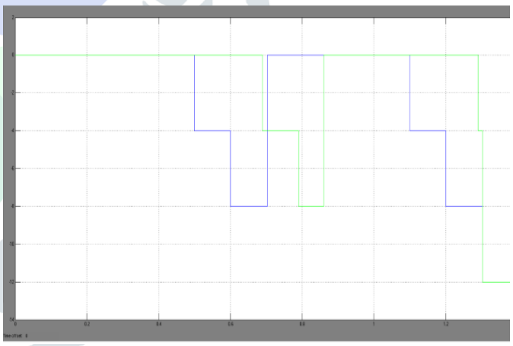

Fig. 25 Simulation results of The DG's total reactive power output

f. Simulation Results of Scenario C

Iin scenario C, the disturbance on the DG2 lags behind that on the DG1 for 250 ms, and therefore, the disturbances do not
overlap with each other.

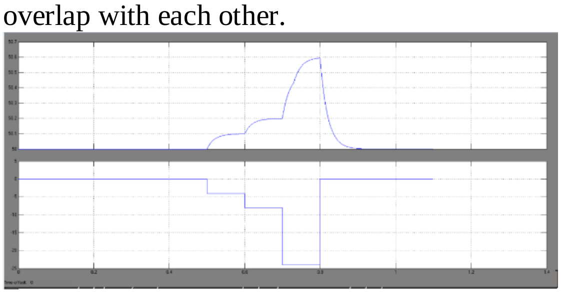

Fig.26 Simulation results of the PCC frequency and separate reactive power output

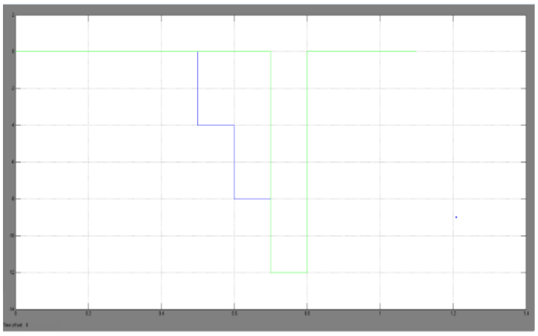

Fig.27 Simulation results of The DG's total reactive power output

VI.CONCLUSION

Under constant power control, the inverter-based DG can either work at unity power factor or create both active and reactive power at the same time. For the DG generating both active and reactive power all the while, this paper investigates the connection between the reactive power disturbance and the recurrence variety amid islanding. In the proposed strategy, two arrangements of reactive power disturbances are composed. They have diverse extents and term time for various purposes. Fundamentally, the FSORPD is included the DG. It is intermittent and it expects to wreck the reactive power adjust between the DG and the heap subsequent to islanding, and afterward, enact the SSORPD.

Consequently, the technique can take out the NDZ. At the point when the FSORPDs are included diverse DGs, they may be offbeat. Considering all the conceivable recurrence variety qualities with these FSORPDs subsequent to islanding, three criterions are outlined also to switch the disturbance from the FSORPD to the SSORPD on the DG. Additionally, DGs situated at various positions can detect a similar recurrence variety attributes regardless of what the activity mode is, which ensures the synchronization of the SSORPDs on various DGs without the need of correspondence. As needs be, the proposed strategy can viably and dependably detect islanding for different DG activity.

REFERENCES

[1] H. B. Puttgen, P. R. MacGregor, and F. C. Lambert, "Distributed generation: Semantic hype or the dawn of a new era?," IEEE Power Energy Mag., vol. 1, no. 1, pp. 22–29, Jan./Feb. 2003.

[2] P. P. Barker and R. W. de Mello, "Determining the impact of distributed generation on power systems: Part 1—Radial distribution systems," in Proc. IEEE Power Eng. Soc. Summer Meeting, Jul. 2000, pp. 1645–1656.

[3] IEEE Recommended Practice for Utility Interface of Photovoltaic (PV) Systems, IEEE Standard 929-2000, Apr. 2000.

[4] IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems, IEEE Standard 1547-2003, Jul. 2003.

[5] R. A. Walling and N. W. Miller, "Distributed generation islanding— Implications on power system dynamic performance," in Proc. IEEE Power Eng. Soc. Summer Meeting, Jul. 2002, pp. 92–96.

[6] G. Hernandez-Gonzalez and R. Iravani, "Current injection for active islanding detection of electronically-interfaced distributed resources," IEEE Trans. Power Del., vol. 21, no.3, pp. 1698–1705, Jul. 2006.

[7] A. Timbus, A. Oudalov, and N. M. Ho Carl, "Islanding detection in smart grids," in Proc. IEEE Energy Convers. Congr. Expo., Sep. 2010, pp. 3631–3637.

[8] D. Reigosa, F. Briz, C. Blanco, P. Garcia, and J. M. Guerrero, "Active islanding detection for multiple parallel-connected inverter-based distributed generators using high-frequency signal injection," IEEE Trans. Power Electron., vol. 29, no. 3, pp. 1192–1199, Mar. 2014.

[9] F. De Mango, M. Liserre, A. D. Aquila, and A. Pigazo, "Overview of antiislanding algorithms for PV systems. Part I: Passive methods," in Proc. IEEE Power Electron. Motion Control Conf., Aug. 2006, pp. 1878–1883.

[10] Z. Ye, A. Kolwalkar, Y. Zhang, P. Du, and R. Walling, "Evaluation of antiIslanding schemes based on nondetection zone concept," IEEE Trans. Power Electron., vol. 19, no. 5, pp. 1171–1176, Sep. 2004.

[11] H. H. Zeineldin, E. F. EI-Saandany, and M. M. A. Salama, "Impact of DG interface control on islanding detection and nondetectionzones," IEEE Trans. Power Del., vol. 21, no. 3, pp. 1515–1523, Jul. 2006.

[12] F. De Mango, M. Liserre, and A. D. Aquila, "Overview of anti-islanding algorithms for PV systems. Part II: Active methods," in Proc. IEEE Power Electron. Motion Control Conf., Aug. 2006, pp. 1884–1889.

[13] J. H. Kim, J. G. Kim, Y. H. Ji, Y. C. Jung, and C. Y. Won, "An islanding detection method for a grid-connected system based on the Goertzel algorithm," IEEE Trans. Power Electron., vol. 26, no. 4, pp. 1049–1055, Apr. 2011.

[14] H. Karimi, A. Yazdani, and R. Iravani, "Negative-sequence current injection for fast islanding detection of a distributed resource unit," IEEE Trans. Power Electron., vol. 23, no. 1, pp. 298–307, Jan. 2008.

[15] A. Yafaoui, B. Wu, and S. Kouro, "Improved active frequency drift antiislanding detection method for grid connected photovoltaic systems," IEEE Trans.

Power Electron., vol. 27, no. 5, pp. 2367–2375, May 2012.

[16] L. A. C. Lopes and H. L. Sun, "Performance assessment of active frequency drifting islanding detection methods," IEEE Trans. Energy Convers., vol. 21, no. 1, pp. 171–180, Mar. 2006.

[17] H. Vahedi and M. Karrari, "Adaptive fuzzy Sandia frequency-shift method for islanding protection of inverter-based distributed generation," IEEE Trans. Power Del., vol. 28, no. 1, pp. 84–92, Jan. 2013.

[18] E. J. Estebanez, V. M. Moreno, A. Pigazo, M. Liserre, and A. DellAquila, "Performance evaluation of active islanding - detection algorithms in distributed-generation photovoltaic systems: Two inverters case," IEEE Trans. Ind. Electron., vol. 58, no. 4, pp. 1185–1193, Apr. 2011.

[19] L. A. C. Lopes and Y. Z. Zhang, "Islanding detection assessment of multiinverter systems with active frequency drifting methods," IEEE Trans. Power Del., vol. 23, no. 1, pp. 480–486, Jan. 2008.

[20] H. H. Zeineldin, E. F. EI-Saandany, and M. M. A. Salama, "Islanding detection of inverter-based distributed generation," Proc. IEE, vol. 153, no. 6, pp. 644–652, Nov. 2006.

[21] H. H. Zeineldin, "A Q–f droop curve for facilitating islanding detection of inverter-based distributed generation," IEEE Trans. Power Electron., vol. 24, no. 3, pp. 665–673, Mar. 2009.

[22] J. Zhang, D. H. Xu, G. Q. Shen, Y. Zhu, N. He, and J. Ma, "An improved islanding detection method for a grid-connected inverter with intermittent bilateral reactive power variation," IEEE Trans. Power Electron., vol. 28, no. 1, pp. 268–278, Jan. 2013.

[23] Y. Zhu, D. H. Xu, N. He, J. Ma, J. Zhang, Y. F. Zhang, G. Q. Shen, and C. S. Hu, "A novel RPV (reactive-power-variation) antiislanding method based on adaptive reactive power perturbation," IEEE Trans. Power Electron., vol. 28, no. 11, pp. 4998–5012, Nov. 2013.

[24] P. Gupta, R. S. Bhatia, and D. K. Jain, "Average absolute frequency deviation value based active islanding detection technique," IEEE Trans. Smart Grid, vol. 6, no. 1, pp. 26–35, Jan. 2015.

[25] X. L. Chen and Y. L. Li, "An islanding detection algorithm for inverterbased distributed generation based on reactive power control," IEEE Trans. Power Electron., vol. 29, no. 9, pp. 4672–4683, Sep. 2014.

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