

## Methods for Protecting Network from Islanding Danger

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### ABSTRACT

The process of energizing loads from other sources like a distributed generator with a total disconnection of utility grid at the point of common coupling is called islanding. The islanding phenomenon affects the network by safety issues and bad impact on the utility and connected loads, especially the workers on the utility. Hence, it must be detected by a suitable anti-islanding (AI) technique which is needed to be faster in terms of time detection and smaller or negligible non-detection zone. To detect this phenomenon, there are local and remote AI techniques. In this paper, local AI techniques are illustrated, which are used for improving the performance regarding the size of the non-detection zone and detection speed.

**Keywords:** Anti-islanding (AI), Distributed Generation (DG), Photovoltaic (PV), Power quality; utility Grid-connected photovoltaic; Islanding detection.

## REFERENCES

- A.G.Abo-Khalil.2020**, Maximum Power Point Tracking for a PV System Using Tuned Support Vector Regression by Particle Swarm Optimization. *Journal of Engineering Research*, 8(4).139-152.
- A.Abokhalil, A.Awan, & A.R.Al-Qawasmi. 2018**, Comparative Study of Passive and Active Islanding Detection Methods for PV Grid-Connected Systems. *Sustainability*, 10(6), 1798.
- A.G.Abo-Khalil. 2011**, A new wind turbine simulator using a squirrel-cage motor for wind power generation systems. 2011 IEEE Ninth International Conference on Power Electronics and Drive Systems IEEE.
- A.H.Mantawy, & M.Al-Muhaini. 2007**, A New particle-swarm-based algorithm for distribution system expansion planning including distributed generation. *Proceedings of the 2nd IASME/WSEAS International Conference on Energy & Environment, (EE'07)*. Portoroz, Slovenia.
- A.Khamis, H.Shareef, E.Bizkevelci, & T.Khatib. 2013**, A review of islanding detection techniques for renewable distributed generation systems. *Renewable and sustainable energy reviews*, 28, 483-493.
- A.Llaria, O.Curea, J.Jime´nez, & H.Camblong. 2011**, Survey on microgrids: unplanned islanding and related inverter control techniques. *Renewable energy*, 36(8), 2052-2061.
- A.S.Aljankawey, W.G.Morsi, L.Chang, & C.P.Diduch. 2010**, Passive method-based islanding detection of renewable-based distributed generation: the issues. 2010 IEEE Electrical Power & Energy Conference IEEE.
- A.Samui, & S.R.Samantaray. 2011**, Assessment of ROCPAD relay for islanding detection in distributed generation. *IEEE Transactions on Smart Grid*, 2(2), 391-398.
- A.Yafaoui, B.Wu, & S.Kouro. 2010**, Improved active frequency drift anti-islanding method with lower total harmonic distortion. *IECON 2010-36th Annual Conference on IEEE Industrial Electronics Society IEEE*.
- B.Anudeep, & P.k.Nayak. 2017**, A passive islanding detection technique for distributed generations. 2017 7th International Conference on Power Systems (ICPS).IEEE. Sandia National Labs., Albuquerque, NM (US); Sandia National Labs.
- B.Bahrani, H.Karimi, & R.Iravani. 2009**, Nondetection zone assessment of an active islanding detection method and its experimental evaluation. *IEEE Transactions on Power Delivery*, 26(2), 517-525.
- B.Guha, R.J.Haddad, & Y.Kalaani. 2015**, A passive islanding detection approach for inverter-based distributed generation using rate of change of frequency analysis. *SoutheastCon 2015, IEEE*.
- B.I.Rani, M.Srikanth, G.S.Ilango, & C.Nagamani. 2013**, An active islanding detection technique for current controlled inverter. *Renewable energy*, 51, 189-196.

- B.Wen, D.Boroyevich, R.Burgos, Z.Shen, & P.Mattavelli. 2015**, Impedance-based analysis of active frequency drift islanding detection for grid-tied inverter system. *IEEE Transactions on industry applications*, 52(1), 332-341.
- B.Yu, M.Matsui, A.G.Abo-Khalil, & G.Yu. 2009**, A Correlation-Based Islanding Detection Method Using Current Disturbance for PV System. *Proceedings of the International Conference on Electrical Machines and Systems ICEMS*. Tokyo, Japan.
- C.H.Yoo, D.H.Jang, S.K.Han, D.S.Oh, & S.S.Hong. 2011**, A new phase drift anti-islanding method for grid-connected inverter system. *8th International Conference on Power Electronics-ECCE Asia IEEE*.
- C.S.Chandrakar, B.Dewani, & D.Chandrakar. 2012**, An assessment of distributed generation islanding detection methods. *International Journal of Advances in Engineering & Technology*, 5(1), 218-228.
- E.O.Schweitzer, D.Whitehead, G.Zweigle, & K.G.Ravikumar. 2010**, Synchrophasor-based power system protection and control applications. *2010 63rd Annual Conference for Protective Relay Engineers IEEE*.
- E.Roland. 1984**, Best, Phase-Locked Loops. In *Theory Design, and Applications* , 53-86.
- F.Liu, Y.Kang, & S.Duan. 2007**, Analysis and optimization of active frequency drift islanding detection method. *APEC 07-Twenty-Second Annual IEEE Applied Power Electronics Conference and Exposition IEEE*. USA.
- F.Liu, Y.Kang, Y.Zhang, S.Duan, & X.Lin. 2010**, Improved SMS islanding detection method for grid-connected converters. *IET renewable power generation*, 4(1), 36-42.
- G.Hernandez-Gonzalez, & R.Iravani. 2006**, Current injection for active islanding detection of electronically-interfaced distributed resources. *IEEE Transactions on power delivery*, 21(3), 1698-1705.
- H.Abdi, A.Rostami & N.Rezaei. 2020**, A Novel Passive Islanding Detection Scheme for Synchronous-type DG using Load Angle and Mechanical Power Parameters. *Electric Power Systems Research*, 106-112
- H.H.Zeineldin, & S.Conti. 2011**, Sandia frequency shift parameter selection for multi-inverter systems to eliminate non-detection zone. *IET Renewable Power Generation*, 5(2), 175-183.
- H.Karimi, A.Yazdani, & R.Iravani. 2008**, Negative-sequence current injection for fast islanding detection of a distributed resource unit. *IEEE Transactions on power electronics*, 23(1), 298-307.
- H.Li, Z.Li, Z.Guo, & J.Lu. 2018**, A Novel Unscheduled Islanding Detection Method for Microgrid. *MATEC Web of Conferences* (Vol. 160, p. 04001). *EDP Sciences*, 14, pp. 810-816.
- H.Vahedi, & M.Karrari. 2012**, Adaptive fuzzy sandia frequency-shift method for islanding protection of inverter-based distributed generation. *IEEE Transactions on Power Delivery*, 28(1), 84-92.

- H.Xu, , Y.Zhang, Z.Li, , R.Zhao & J.Hu, 2020**, Reactive Current Constraints and Coordinated Control of DFIG's RSC and GSC During Asymmetric Grid Condition. *IEEE Access*, 8, 184339-184349.
- J.H.Kim, J.G.Kim, Y.H.Ji, Y.C.Jung, & C.Y.Won. 2011**, An islanding detection method for a grid-connected system based on the goertzel algorithm. *IEEE Transactions on Power Electronics*, 26(4), 1049-1055.
- J.Merino, P.Mendoza-Araya, G.Venkataramanan, & M.Baysal. 2014**, Islanding detection in microgrids using harmonic signatures. *IEEE Transactions on Power Delivery*, 30(5), 2102-2109.
- L.P.Raghav, & T.Sandhya. 2014**, An active frequency drift method for an islanding detection of grid connected micro turbine generation system. *Int. J. Innovat. Res. Sci. Eng. Technol.*–(ICETS'14), 3(1).
- M.A.Eltawil, & Z.Zhao. 2010**, Grid-connected photovoltaic power systems: Technical and potential problems—A review. *Renewable and sustainable energy reviews*, 14(1), 112-129.
- M.El-Moubarak, M.Hassan, & A.Faza. 2015**, Performance of three islanding detection methods for grid-tied multi-inverters. 2015 IEEE 15th International Conference on Environment and Electrical Engineering (EEEIC) IEEE.
- M.F.N.Khan. 2020**, A Novel Probabilistic Generation Model for Grid Connected PV Based Distributed Generation. *Journal of Engineering Research*, 8(1),230-401.
- M.Ropp, D.Larson, S.Meendering, D.McMahon, J.Ginn, J.Stevens, et al. 2006**, Discussion of a power line carrier communications-based anti-islanding scheme using a commercial automatic meter reading system. 2006 IEEE 4th World Conference on Photovoltaic Energy Conference IEEE.
- M.S.Kim, R.Haider, G.J.Cho, C.H.Kim, C.Y.Won, & J.S.Chai. 2019**, Comprehensive review of islanding detection methods for distributed generation systems . *Energies*, 12(5), 837-845.
- M.Vatani, T.Amrall, & I.Soltan. 2014**, Comparative of Islanding Detection Passive methods for Distributed Generation Application. *International Journal of innovation & Scientific Research*, 8(2), 234-241.
- Mango, F., M.Liserre, & A.Dell'Aquila. 2006**, Overview of anti-islanding algorithms for pv systems. part ii: Activemethods. 2006 12th International Power Electronics and Motion Control Conference IEEE.
- N.Boonyapakdee, T.Sapaklom, & M.Konghirun. 2013**, An implementation of improved combine active islanding detection method based on frequency and phase perturbations. 2013 International Conference on Electrical Machines and Systems (ICEMS) IEEE.
- P.Du, Z.Ye, E.E.Aponte, J.K.Nelson, & L.Fan. 2010**, Positive-feedback-based active anti-islanding schemes for inverter-based distributed generators: basic principle, design guideline and performance analysis. *IEEE transactions on power electronics*, 25(12), 2941-2948.

- P.Gupta, R.S.Bhatia, & D.K.Jain. 2018**, Active Islanding Detection Technique for Distributed Generation. INAE Letters, 3(4), 243-250.
- P.Mahat, Z.Chen, & B.Bak-Jensen. 2008**, Review of islanding detection methods for distributed generation. 2008 third international conference on electric utility deregulation and restructuring and power technologies IEEE.
- P.Mahat, Z.Chen, & B.Bak-Jensen. 2011**, Review on islanding operation of distribution system with distributed generation. 2011 IEEE Power and Energy Society General Meeting IEEE.
- R.Nale, & M.Biswal. 2017**, Comparative assessment of passive islanding detection techniques for microgrid. 2017 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS).IEEE.
- R.Nale, K.Venkatanagaraju, S.Biswal, M.Biswal, & N.Kishor. 2018**, Islanding detection in distributed generation system using intrinsic time decomposition. IET Generation, Transmission & Distribution, 13(5), 626-633.
- S.Dutta, P.K.Sadhu, M.J.B.Reddy, & D.K.Mohanta. 2018**, Shifting of research trends in islanding detection method-a comprehensive survey. Protection and Control of Modern Power Systems, 1(1), 322-330.
- S.I.Jang, & K.H.Kim. 2004**, An islanding detection method for distributed generations using voltage unbalance and total harmonic distortion of current. IEEE transactions on power delivery, 19(2), 745-752.
- T.Skocil, O.Gomis-Bellmunt, D.Montesinos-Miracle, S.Galceran-Arellano, & J.Rull-Duran. 2009**, Passive and active methods of islanding for PV systems. 2009 13th European Conference on Power Electronics and Applications IEEE, 1-10.
- T.Zheng, H.Yang, R.Zhao, Y.Kang, & V.Terzija. 2018**, Design, evaluation and implementation of an islanding detection method for a micro-grid. Energies, 11(2), 323-330.
- V.E.Santos, A.G.Martins, & C.H.Antunes. 2006**, A multi-objective model for sizing and placement of distributed generation. WSEAS Transactions on Power Systems, 1(7), 1267-1272.
- W.Huang, T.Zheng, F.Yuan, Z.Wang, S.Xu, X.Wang, et al. 2013**, Analysis of the NDZ formulation theory of active frequency shift islanding detection method for grid-connected PV system. 2013 IEEE PES Asia-Pacific Power and Energy Engineering Conference (APPEEC) IEEE.
- W.Xu, G.Zhang, C.Li, W.Wang, G.Wang, & J.Kliber. 2007**, A power line signaling based technique for anti-islanding protection of distributed generators—Part I: Scheme and analysis. IEEE Transactions on Power Delivery, 22(3), 1758-1766.

- W.Xu, K.Mauch, & S.Martel. 2004**, An assessment of distributed generation islanding detection methods and issues for Canada. CANMET Energy Technology Centre-Varenes, Natural Resources Canada, QC-Canada, Tech. Rep. CETC-Varenes.
- X.Wang, W.Freitas, & W.Xu. 2011**, Dynamic non-detection zones of positive feedback anti-islanding methods for inverter-based distributed generators. *IEEE Transactions on Power Delivery*, 26(2), 1145-1155.
- X.Guo. 2016**, Experimental verification of a new positive feedback islanding detection method for grid-connected inverter. *Journal of Engineering Research*, 4(3).
- Y.A.Elshrief, A.D.Asham, D.H.Helmi, & B.A.Abozalam. 2019**, Merits and Demerits of the Distributed Generations Connected to the Utility Grid. *Menoufia Journal of Electronic Engineering Research(ICEEM2019-Special Issue)*, 259-262.
- Y.A.Elshrief, A.D.Asham, D.H.Helmi, & B.A.Abozalam. 2019**, On Remote Anti-Islanding Detection Techniques. *THE FUTURE OF ELECTRICITY CHALLENGES AND OPPORTUNITIES*, 297-304.  
<https://cigre.moere.gov.eg/pages/publication>.
- Y.A.Elshrief, A.D.Asham, D.H.Helmi, & B.A.Abozalam. 2019**, ROCOF for detecting Islanding of Photovoltaic system. *Menoufia Journal of Electronic Engineering Research (ICEEM2019-Special Issue)*, 255-258.
- Y.A.Elshrief, S. Abd-Elhaleem, A.D.Asham, & B.A.Abozalam. 2020**, AI protection Algorithms for PV-Grid Connection System. *International Conference on Innovative Trends in Communication and Computer Engineering (ITCE)*, 334-341.