A Patented Distributed Generator Unintentional Islanding Detection Scheme

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Island Definition

• Following paraphrased from IEEE 1547
• Island ≈ Disconnected portion of Area EPS that is energized by Local EPS
• Area EPS refers to utility
• Local EPS refers to the customer
IEEE 1547 on Islanding

• Cease to energize island in 2 seconds
• Conformance test in IEEE 1547.1
• One test applicable to all DR
• Alternate test for synch generators
• Different test if reverse power used for islanding protection
Reverse Power Protection

• Simplest method for anti-islanding
• Trips if customer exports power
• Can set to trip if minimum import not maintained by customer
• Different test to verify conformance
• Limitation: customer cannot export
Island Detection

- Easy for large power imbalance due to over/under frequency
- Hardest for DR with matched load
- IEEE 1547.1 requires matched load
- Procedure for synchronous generators
Synchronous DG Test

Diagram:

- DG
- LOAD
- B0
- B1
- S1
- Simulated Area EPS
Perturbation Method

- Add 1 Hz perturbation to throttle
- Perturbation during GPM mode
- Negligible effect on freq if connected
- Noticeable effect if islanded
- Fast enough to meet IEEE 1547
- Slow enough to not affect PQ
Detection Index

- Frequency signal sampled 36 Hz
- 1 Hz component of frequency by DFT
- Index $\rho = 324 \times$ squared mag. of 1Hz
- Threshold test for $\rho$
Frequency during test
Index $\rho$ during test
References


• Patent Title: "Integrated and Optimized Distributed Generation and Interconnect System Controller"