

Acknowledgements

I certify that all the material in this thesis that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this thesis reflect my own personal views, and are not necessarily endorsed by the University.

(Signature)

(Date)

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Abstract

This thesis introduces a new passive islanding detection technique for inverter based grid connected distributed generation (DG) systems. This method is based on fast estimation of voltage angle and is compared with another passive islanding detection method based on power factor angle estimation. A fuel cell based DG system is simulated using MATLAB/SIMULINK program and the two methods are simulated. Furthermore, an experimental system is implemented using microcontroller technology to facilitate the comparison between the two methods. Many study cases are considered in order to investigate the performance of the two algorithms under different loading conditions. There are study cases show also the effect of system dynamics on the effectiveness of the two methods. Simulation results as well as experimental results explore the successfulness of the proposed method. The main advantages of the proposed voltage angle detection method based on ADALINE algorithm are its independency on either the load power factor or power system dynamics and its quick response as it detects islanding condition in less than 0.1 second.

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Acronyms

ADALINE	Adaptive linear neuron
AFC	Alkaline fuel cell
BOP	Balance of power
CHP	Combined heat and power
CRO	Cathode ray oscilloscope
DAC	Digital to analog converter
DG	Distributed generation
HCC	Hysteresis current control
IGBT	Insulated gate bipolar transistor
IIR	Infinite impulse response
LMS	Least mean square
MCFC	Molten carbonate fuel cell
NDZ	Non detective zone
PAFC	Phosphoric acid fuel cell
PCC	Point of common coupling
PCU	Power conditioning unit
PEMFC	Proton exchange membrane fuel cell
PI	Proportional integral
PLCC	Power line carrier communication
Q	Quality factor
R	Receiver
ROCOF	Rate of change of frequency
RLS	Recursive least square
SCADA	Supervisory control and data acquisition
SOFC	Solid oxide fuel cell
T	Transmitter
THD	Total harmonic distortion
WLSE	Weighted least squares estimation