Available online at www.sciencedirect.com

SciVerse ScienceDirect

Energy Procedia 17 (2012) 349 – 355

Energy Procedia

2012 International Conference on Future Electrical Power and Energy Systems

An Intelligent Adaptive Method for Islanding Detection in Grid-tied PV System*

Guohui Zeng, Minnian Cao and Yuchen Chen

College of Electrical and Electronic Engineering Shanghai University of Engineering Science
Shanghai, P. R. China
zengcoffee@gmail.com

Abstract

Photovoltaic (PV) systems can be tied to a utility grid to work more effectively as an alternative energy sources. One of the major issues about grid-tied PV systems is to avoid non-intentional operation in islanding mode. Many methods have been proposed to detect islanding operation of grid-tied PV systems. They have different non-detection zones for different kinds of load. This paper presents an intelligent adaptive method for islanding detection in grid-tied PV system. The simulation and test results prove its effectiveness and superiority.

Keywords: Grid-tied PV system. Islanding detection. Adaptive. Non-detection zone.

* This work is supported by SUES DSF Project A24000821 to G. Zeng and SUES SF Project 2008XZ02 to M. Cao.

 doi:10.1016/j.egypro.2012.02.105

1. Introduction

As an electrical power sources, PV systems can be connected to the utility grid to work more reliably and effectively. However, one of the most serious issues about the grid-tied PV systems is islanding operation. Islanding operation is a situation in which the PV system keeps supplying electric power to a section of the grid even when the section has been isolated from the main utility grid. Islanding is undesirable because it poses a safety hazard to utility service personnel, and also because it can lead to asynchronous reclosure which can damage the equipment [1][2].

For an island condition to occur, the situation must be such that the inverter does not recognize an interruption in utility service. If the loads that remain on the isolated portion of the grid are closely matched to the output of the inverter, it is possible for voltage and frequency to remain relatively constant after interruption of the utility grid. Anti-islanding schemes that depend on only monitoring the voltage and frequency may not detect this condition, and continue energizing the local load thus creating an island.

Many anti-islanding techniques have been proposed and a number have been implemented in actual grid-tied PV systems. A reliable anti-islanding scheme must work for all possible islanding scenarios [3][4].

2. Anti-islanding methods

A large number of methods for detecting the islanding condition are used. Requirements for the performance of these methods have been spelled out by the International Electrotechnical Commission (IEC), the Underwriters Laboratories Inc. (UL), the Institute of Electrical and Electronics Engineers (IEEE) and several other "National Standards" [5][6][7]. The typical PV system where the anti-islanding methods have to be implemented is shown in Fig. 1. It is the case of a photovoltaic (PV) generator connected to the grid. The components forming the system are: the PV panel, the power inverter, the isolation transformer and the parallel local load.

Currently, the anti-islanding methods are clearly grouped into three categories as a function of their operating mode. These three categories are:

• Passive methods resident in the grid tied inverter.
• Active methods resident in the grid tied inverter.
• Methods not resident in the PV system but communicating the PV system and the utility.

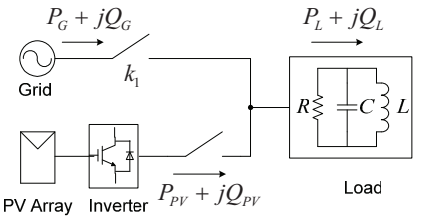

Fig. 1 Interconnection of PV system to the grid and the load

2.1Passive methods

This kind of methods lies in the inverter. They are base on the monitoring of certain characteristic parameters in the point of common coupling (PCC). The anti-islanding method causes the disconnection of the inverter from the utility grid under fault conditions when the parameter monitored, different for each method, gets out of the control range considered as usual during the normal operation.