
Novel Method of Phase & Frequency Extraction during Grid Abnormalities

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ABSTRACT

Due to the rapid growth in utilization of Distributed Power Generating Systems (DPGS) and its connection to the utility grid, an inevitable overcome capacity of DPGS during the short grid disturbances is needed. The synchronization unit which is the central part in the grid-side control strategies of converter, plays a big role in this difficulties. Auto-adjustable Synchronous-Reference-Frame Phase-Locked-Loop (ASRF-PLL) is a better choice for the purpose of synchronization over the conventional SRF-PLL. But by the inclusion of second order generalized integrator (SOGI), in the area of ASRF-PLL, provides a lot of advantage to the synchronizing unit. This paper proposes a combine approach of ASRF-PLL and SOGI for the achievement of better results. It is first illustrated how the positive and negative sequence extracted from unbalance supply in both 3-phase and 2-phase systems and further given a brief illustration of both ASRF-PLL and SOGI (QSG and FLL). Then the combine approach is described in MATLAB and experimentally verified by the use of LABVIEW-2010 with the inclusion NI USB-6341 (Data acquisition system). Advantages like frequency adaptions of entire system, estimation of positive and negative sequence fundamental component without use of butter-worth filter and frequency estimation is done without use of any extra frequency detection technique. Filtering delay also absent, though we are not using any filter.

KEYWORDS

Synchronization, FLL, SOGI-FLL, AGFLL, DSOGI-FLL, MATLAB/SIMULINK, LAB View

INTRODUCTION

Synchronization unit is indispensable for the operation of a large number of generating stations in unison. However inverter control of Distributed Power Generation Stations (DPGSs) require adequate information of power system network at PCC. Hence continuous and proper grid condition monitoring of phase and frequency are essential for the operation of inverter. The demand for energy, collectively with the growing interest in clean technologies leads to the development of power distribution systems using renewable energy [1]. For this it is needed a better controllability and reversible power flow capability for electrical power conversion system. For the connection of grid side converters to the power system network, synchronization unit needs the major concern. Grid-connected converters should be perfectly synchronized with the power system network, to support the grid service under unbalance and distorted condition.

Synchronous reference frame PLL (SRF-PLL) [2] has become a formal grid synchronization technique in three phase systems. But as per its response concerned, it deviates from its required response at the distorted grid voltage condition. This drawback overcame by using decoupled double synchronous reference frame PLL (DDSRF-PLL) [3]. In this method two synchronous reference frames and a decoupling network is used to isolate the effects of positive- and negative sequence voltage components. To overcome the drawback of SRF-PLL, Auto adjustable synchronous reference frame PLL (ASRF-PLL) is used [4][5]. Furthermore an interesting synchronization technique for variation frequency environment was discussed in [6]. In this technique three single-phase independent enhanced phase-locked loops (EPLL) are united with a positive-sequence calculator. And there is no need of any synchronous reference frame for the synchronization of distorted grid networks. Using frequency-locking instead the conventional phase-locking with similar methodology was confronted in [7]. In 2008 P. Rodríguez with his associate proposed a new method of synchronization called Multiple Second Order Generalized Integrators Frequency Locked Loop (MSOGI-