

A Comprehensive Review of Synchronization Methods for Grid-Connected Converters of Renewable Energy Source

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ABSTRACT

Recent interest in the integration of renewable energy sources (RES) into the power grid has raised concerns in synchronization of the various RES. Grid variables such as voltage, phase angle and frequency should be continuously monitored to guarantee correct operation and synchronization of power converters connected to the power grid. Numerous synchronization methods have been presented over the years to address issues such as unbalanced condition and frequency variation. This paper presents a review of past studies on synchronization methods for grid-connected converters together with their control and modeling techniques. Various estimation techniques for phase angle, frequency and harmonic are discussed and examined. Key challenges for a smart and efficient synchronization are briefly overviewed and possible future works are also recommended. A consolidated review is the particular focus of this paper, as is the provision of information on the best method for synchronizing grid-connected converters.

KEYWORDS: Grid synchronization; Grid-connected converter; Phase angle estimation; Frequency estimation; Phase-locked loop

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