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Pll-Based 3ϕ inverter circuit for microgrid system operated by electrostatic generator (Article) (Open Access)

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Abstract

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A current source control based PLL (phase lock loop) technique is one of the most efficient methods for modern 3ϕ synchronized grid power systems. When an inverter circuit is driven by an electrostatic generator with wind power, it encounters some problems, such as static and dynamic turn-on-off switching losses, unbalanced source voltage, low continuous current, higher frequency harmonic distortion, phase angle imbalance, etc. To solve these problems, a series of connected switching inverter modules technique is proposed. It is not only a traditional inverter system , but it also works as a low-frequency ripple current inverter with lower switch losses. A new topology of phase synchronous inverter (PSI) is designed using a PLL current source controller. The input voltage source of the PSI is a high DC voltage from an electrostatic generator (ESG). The modified ESG is capable of generating the HVDC and a continuous moderate amount of current. The proposed switching topology of the inverter is able to control the microgrid power as well as reduce the dynamic and static switching loss. It also reduces the high-frequency harmonic distortion and improves the phase angle error. The output LCL lowpass filter scheme of the inverter is designed to reduce the total harmonic distortion of 1.62%. The PSI circuit is designed and simulated using MATLAB software. In the developed system , the input voltage of 8 kV_{DC}, microgrid frequency of 50Hz, switching frequency of the carrier of 10 kHz, and modulation index of 0.85 are considered to be implemented. The proposed novel microgrid connected PSI switching module design technique has significantly enhanced the power stability. The overall system efficiency improved by 95.52%. © 2019, International Islamic University Malaysia-IIUM.

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Current controller | Inverter switching topology | Microgrid | Output LCL filter | PLL | PSI | PWM controller

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