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Synchronous PWM regulation of inverters in transformer-based photovoltaic installations

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Abstract

This paper provides a brief review of research results on alternative approaches, methods, and computational procedures for synchronous space-vector pulse-width modulation (PWM) applied to inverters of photovoltaic (PV) systems using transformers, with reduced inverter switching frequency. Specifically, the core methods and techniques of synchronous space-vector PWM have been updated and adapted for inverter units in several advanced PV system architectures. This includes inverter modules using both traditional three-phase voltage-source inverters (VSIs) and neutral-point-clamped (NPC) converters. The simulation results provide insight into the behavior of photovoltaic installations with two- and three-inverter systems. The presented methods and algorithms of synchronous spacevector PWM used for the regulation of inverters in gridconnected PV installations effectively ensure continuous synchronization and symmetry of the power transformer winding voltage throughout its entire operating range. This ensures that the magnitudes of even harmonics and unwanted subharmonics in the voltage spectrum of the power transformer winding are reduced to zero, leading to reduced losses in systems and increased efficiency.

Keywords*: photovoltaic systems; spectral analysis; voltage regulation*

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