

# **Research on reducing current harmonics for grid-connected solar inverters using modulation technique with variable switching cycle**

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**Abstract:** This thesis investigates a harmonic reduction method for grid-connected photovoltaic inverters using a modulation technique based on a variable switching cycle. Conventional fixed-frequency pulse-width modulation (PWM) generates concentrated harmonic spectra, complicating filter design and increasing system cost. The proposed approach dynamically adjusts the switching period according to a predefined pattern, effectively spreading the harmonic energy over a wider frequency range. This spectral dispersion reduces the amplitude of dominant harmonic components without requiring additional passive filters or complex control algorithms. A detailed analysis of the modulation principle and its impact on total harmonic distortion (THD) is presented. Simulation and experimental results on a single-phase grid-tied inverter validate the technique, demonstrating significant suppression of low-order harmonics while maintaining stable grid synchronization and power quality. The findings offer a cost-effective and easily implementable solution for improving the electromagnetic compatibility of photovoltaic systems, contributing to more efficient and reliable renewable energy integration.

**Keywords:** harmonic reduction, solar inverter, variable switching cycle modulation, grid-connected