

Variable switching frequency hybrid PWM technique for switching loss reduction in a three-phase two-level voltage source inverter

Anas Ibrahim, Muhamad Zahim Sujod

Faculty of Electrical and Electronic Engineering, University Malaysia Pahang, 26600 Pekan,
Pahang, Malaysia

ABSTRACT

Power loss reduction is one of the main objectives in power electronic system design for achieving higher efficiencies and enhancing system reliability. In this regard, this paper aims to develop a variable switching frequency hybrid pulse width modulation (VSF-HPWM) method to maximize loss saving while maintaining the same current total harmonic distortion (THD) of the conventional scheme. In doing so, this technique utilizes the modulation signal and the switching frequency simultaneously. Using a predefined mathematical representation of current ripple in every switching cycle, the modulating signal (either discontinuous or conventional space vector modulation) with lower RMS current ripple is applied. Meanwhile, the number of commutations under the constraints of constant RMS ripple is reduced by varying the switching frequency. The performance analysis is validated through MATLAB Simulink which shows that the proposed strategy can save up to 53% of switching losses with a similar THD of the conventional scheme.

KEYWORDS

Voltage source inverter (VSI); Switching losses; Total harmonic distortion (THD); Discontinuous pulse width modulation (DPWM); Conventional space vector modulation (CSVPWM); Variable switching frequency (VSF)

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