Three-phase three-level shunt active power filter with simplified synchronous reference frame

ABSTRACT

Shunt active power filter (SAPF) is the most effective solution to current harmonics. In its controller, Synchronous Reference Frame (SRF) principle has widely been applied in current harmonics extraction algorithm due to its simple implementation features. However, the conventional SRF algorithm performs with serious time delay due to strong reliance on sluggish numerical filters. Moreover, the algorithm is still considered to possess unnecessary features which impose excessive computational burden to the designed controller. Therefore, this paper presents a simplified SRF algorithm with improved performance for the purpose of current harmonics extraction in three-phase three-level neutral-point diode clamped (NPC) inverter-based SAPF. Two potential modifications are implemented which include replacement of numerical filter with mathematical based average identifier to improve mitigation performance and removal of redundant features to reduce algorithm complexity. The proposed algorithm is developed and evaluated in MATLAB / Simulink. Simulation results have confirmed the improvement achieved by the proposed algorithm in comparison to the conventional algorithm.

Keyword: Current harmonics; DQ theory; Multilevel inverter; Power quality; Shunt active power filter (SAPF)