DC-link capacitor voltage control for single-phase shunt active power filter with step size error cancellation in self-charging algorithm

ABSTRACT

This study presents an improved self-charging algorithm by introducing a new feature known as step size error cancellation for better performance of DC-link capacitor voltage control in single-phase shunt active power filter (SAPF). Previous works of self-charging algorithms were focused only for steady-state operation by using either proportional-integral (PI) or fuzzy logic control (FLC). However, in a certain operation of any power system, dynamic operation may also happen. Thus, by introducing step size error cancellation as an additional feature to the self-charging algorithm, both steady state and dynamic operations can be covered. For evaluation and comparison analysis, self-charging with PI and FLC algorithms have been developed too. All the algorithms were simulated in MATLAB-Simulink, respectively, together with the single-phase SAPF. For hardware implementation, the proposed algorithm was programmed in TMS320F28335 digital signal processing board. The other two conventional self-charging algorithms were also programmed for comparison purposes. From the results and analysis, the proposed self-charging with step size error cancellation shows the best performance with high accuracy, fast response time and less overshoot and undershoot. It performs well in both steady state and dynamic operations as compared with both previous self-charging techniques which only work well in steady-state operation.

Keyword: DC-link capacitor voltage control; Self-charging algorithm; Step size error cancellation; Single-phase shunt active power filter (SAPF)