**ABSTRACT**

Static compensator (STATCOM) offers the optimal solution in terms of price, reliability, and dynamic performance. Reduced component count, simpler layout for switches, and smaller dc-link capacitor values are the attractive features of the proposed topology over the diode clamped and cascaded multilevel converters. This proposed work suggests further improvements in this topology. Suitable selection of the dc-link voltage values reduces distortion in the current fed to the grid. In addition, circuit topology is modified to avoid the split-capacitor dc links. This reduces the number of independent dc capacitor voltages to be controlled and eliminates the flow of third-harmonic current through the transformer. In order to improve the performance, a phase-shifted carrier-based pulse width modulation technique is used. The effectiveness of the scheme is verified through detailed simulation study. In the twin converter topology, the dc-link voltages of both VSCs are maintained equal. Therefore, only three-level operation is achieved. However, in the open-ended transformer topology, the dc-link voltage of VSC-2 is regulated to half that of VSC-1. This ensures four-level operation of the circuit. Therefore, low THD is achieved with reduced filter requirements as compared to three-level twin converter topology.

In the proposed topology, only two dc voltages have to be controlled. Furthermore, the ratio of the dc-link voltages of the two VSCs is selected such that low distortion in current is achieved. A dc-link voltage controller has been proposed to regulate the dc-link voltages of the two converters by drawing requisite amount of real power from the utility and by differentially distributing them between the two converters. A mathematical model of the system is developed to facilitate the design of the controller.

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