ABSTRACT

This report presents a novel three-phase three-level DC/DC converter using zero-voltage zero-current switching (ZVZCS) method, in order to reduce switching losses during the start of turning on and turning off in semiconductor devices, by using phase-shifted pulse width modulation (PSPWM) signals which are generated from a 16 bit microcontroller. This proposed converter consists of three-level inverters that have some advantages. Not only does the voltage stress of semiconductor devices decrease to half of the input dc voltage at the turning-off time, but the total harmonics voltage distortions (THDv) of the output inverter also decrease when being compared to the two-level inverters. The semiconductor devices within this circuit can operate under zero-voltage (ZVS) and zero-current (ZCS) conditions by using the energy of leakage inductances and dc blocking capacitors. However, the devices still can completely achieve soft switching conditions without the need of dc blocking capacitor being used in circuit. This can be explained by the balanced current's principle of three-phase transformer. The proposed converter has been designed and tested at 3.5 kW rated power, input dc voltage of 530 V, output dc voltage of 110 V at the switching frequency of 50 kHz. It was found that the converter has maximum efficiency of 92.52 %.