Chapter – 10

Conclusion and Scope for Further Work

The rapid advancement of power electronics in recent years has demanded sophisticated, efficient, light-weight soft-switched switch mode power supply (SMPS) with high power to volume ratio. In order to develop an improved performance SMPS, a hybrid ZVZCS phase-shift PWM dc/dc converter has been proposed in this work. The converter with full bridge configuration uses two power MOSFETs as leading leg devices and two IGBTs as lagging leg devices. This arrangement has eliminated the problem of current tail associated with IGBTs. Thus it has been made possible to achieve higher efficiency, wide duty-cycle range and higher frequency range of operation. Phase-shift PWM IC UC3879 has been used for the control circuit with voltage mode control and over current protection. The performance of the converter has been verified through computer simulation as well as hardware implementation.

Now-a-days to improve input power factor of SMPS, a power factor correction circuit is also incorporated with an SMPS. The power factor correction is performed by a high frequency switching dc/dc converter, which forces the input current to follow the line voltage. In the present work, a ZCS boost converter for active power factor correction has been proposed, which uses two auxiliary switches, two inductors and a resonant capacitor. All the switches used in this converter are turned on and turned off at zero-current with minimum current stress. The boost diode is also commutated softly.

Another fully soft-switched boost converter suitable for active power factor correction is also proposed. This converter uses only one auxiliary switch. The active
switches do not require isolated gate drive, simplifying the control circuit. The main and auxiliary switches turn on with zero-current. The main switch turn-off is with zero-voltage and zero-current, while the auxiliary switch turn-off is with zero-voltage. Boost power factor IC UC3854 has been used along with a small additional circuitry for the proposed converter. Performance of the converter has been verified through computer simulation as well as experiment with laboratory prototype.

A modified version of new fully soft-switched boost converter for active power factor correction has also been proposed in this work. This modified converter uses an auxiliary circuit using less number of components than the earlier version. Both the switches of this converter turn on with zero-current and turn off with zero-voltage. Same control circuit as used by its earlier version has been used for this converter. Performance of this converter has been verified through computer simulation as well as laboratory prototype.

However, there is still some scope for investigation and also improvement of the soft-switched SMPS. The performance of the ZVZCS phase-shift PWM converter has not been studied at light load and no load conditions. Moreover, the current stresses of the power switches are relatively high due to resonant charging of the coupling capacitor. So, efforts can be made to reduce the initial high peak current of the switches. The performance of the ZCS boost converter has been verified through computer simulation. However real life performance of the proposed ZCS boost converter can only be realised through a laboratory prototype test. Although the boost converter proposed in chapter-7 operates under fully soft-switched condition, it is noticed that the voltage and current stress of the auxiliary switch is relatively high. The modified converter also suffers from
the drawback of higher device stress. So there is some scope of improvement in respect of
device stress. Some recent works suggest that use of coupled inductor in boost converter
can yield higher output voltage in continuous conduction mode. So, the circuits proposed
in this work have some scope of development in duty cycle range using coupled inductor
maintaining the soft-switching behaviour.