CHAPTER 7

CONCLUSION

7.1 GENERAL

In this thesis, the role of power electronics in an automotive environment and various DC-DC converter topologies for automotive applications that are available in the literature were discussed in Chapter 1 and Chapter 2. It was observed that isolated topologies which use a transformer are not preferred for automotive applications due to the high voltage stress across the switches, leakage inductance of the transformer and bigger size. Soft switched RC is found to be a better solution.

Based on the voltage gain and load regulation requirement for a wiper motor application, several LCC resonant topologies are chosen and analysed. One topology is proposed in Chapter 3 based on the voltage gain and load voltage regulation requirement. In this thesis, the size of the resonant tank is minimized by optimising the energy stored in the resonant tank ($E$) and kVA/kW ratio. Simulation results show that the optimally designed resonant tank elements provide the required voltage gain and soft switching of the power switches within the specified output voltage regulation.

The performance of the converter under normal temperature is satisfactory. However, to verify the converter’s performance under temperature variation, details on the temperature sensitive parameters like the ON state drain to source resistance of the power MOSFET ($R_{DS-ON}$), the leakage current and the forward current of the power diode are provided in Chapter 5. Based on modified simulation model that included variations in
temperature sensitive parameters, it is observed that the tight voltage regulation is obtained even under temperature variation. Therefore, simple open loop configuration is sufficient to obtain the desired voltage gain even when temperature varies.

The proposed converter was practically implemented. It is observed from the practical results obtained from the experimental setup that the proposed converter is superior to the existing converter in terms of size, efficiency and cost.

7.2 SCOPE FOR FUTURE WORK

The present work can be extended for a main drive motor application in EV, which requires multi-quadrant operation of the proposed converter. The topology may also be used by suitably including a transformer to achieve multi-quadrant operation. Also, the increment in battery life due to increment in efficiency and energy saving feature of a multi-quadrant operation can be studied.