CHAPTER 7

CONCLUSIONS

Conclusions

This research is primarily focused on design and development of Direct AC-AC converters for practical industry applications. Direct AC-AC conversion topology with high frequency applications is proposed. A simplified control algorithm is modeled and analyzed for the control A prototype is developed and control using both analog and advanced Digital electronics has been built to demonstrate the feasibility of the proposed control technique and topology.

In Chapter I, a brief overview on all the methods starting from electro mechanical MG sets to sophisticated AC-DC-AC converters with front end controllers, that are used for conversion of AC voltages with one frequency and a fixed voltage magnitude to AC voltages with arbitrary frequency and variable voltages have been presented.

In Chapter II, a generalized static transformer (MxN switch model) has been explained in detail with both the modes of control i.e. direct mode and indirect mode. This model is capable of voltage and frequency transformation along with phase transformation. Detail simulation has been carried out for both the control topologies and results supporting the feasibility of the generalized static transformer are incorporated in this chapter. All the practical issues related to the implementation of the generalized AC-AC converter are addressed and discussed in detail.

In Chapter III, generation of high frequency voltages from a low frequency supply voltages is explained. The generalized structure and the control explained in chapter II is modified and used as per the requirements for generation of high frequency voltages. Further the transformation of phases i.e. from three-phase to single phase along with transformation of frequency from utility supply frequency to high frequency is explained. The mechanism of generating the high frequency waves with 50% duty cycle is explained in detail. This aids in achieving the galvanic isolation by using high frequency transformer. Adding secondary converter on the other side of the high frequency transformer did further extension of this technique as an inter connection between two sources. The secondary is modified to explain the functionality of the proposed converter in a better way.

Chapter IV emphasis on the practical implementation aspect of the converter proposed in chapter III. Detailed explanation on the implementation of control mechanism using analog circuit is given along with the experimental results. Further implementation of the same control using microcontrollers and digital Ics is explained. Implementation of the bidirectional switch using the discrete components as well as the commercially available bidirectional switch module is explained and the pictures of the set up at each are included. The experimental results indicate the better performance of the proposed topology and the feasibility of its usage for industrial applications.

In Chapter V, a new direct AC-AC converter topology with reduced number of switches is explained. The reduction process from eighteen switches to three switches is explained. Detailed simulation of the proposed converter is carried out and the results incorporated verify the better feasibility of the proposed converter for unidirectional power flow applications. Experimental results support the simulation study and indicate the unity power factor at the source side even at poor PF loads.

In chapter VI, an application of the proposed converter for the variable speed wind turbine is explained. The generalized technique for the control of doubly fed induction generator is explained and its implementation to the proposed converter is discussed.

Suggestions for the future work

Continuation of the work in this dissertation could be focused on the unbalanced input voltage and unbalanced output load conditions. The converter topologies presented in Chapters III and V are based on balanced input voltage systems. Further investigation would also be required for any disturbance such as transients, sags and swells on either side of the converter at the time when it acts as an interconnection between the two links. A suitable control algorithm can be designed and implemented for unbalanced conditions. Practical implementation can be done to study and verify the control for unbalanced and transient conditions.