

Preface

High gain converters are very popular now-a-days due to large demand in the area of microgrid based renewable energy resources. The renewable energy resources have low voltage generation sources which required high voltage gain converters to step-up the input dc voltage. Also, multi-output converters are demanded in the present scenario due to a requirement of different ac and dc load demands. The conventional converters used for this purpose have few limitations such as duty cycle is limited and they have to operate on extreme duty cycle to achieve high gain. To encounter these problems converter are designed and proposed for high gain in less duty cycle.

Most of the high gain converters are derived from the conventional boost or buck-boost converters. The control-to-output transfer function of boost and buck-boost derived converters also suffer from right half plane zero problems. Due to the presence of right half plane zero, controller design becomes difficult. So, in this thesis, high gain inverter is proposed which is capable of giving simultaneous ac and dc outputs with no right half plane zero. The proposed inverter is also capable to give high dc voltage gain with low duty cycle. Detailed analyses, modeling experimental verification are presented in this thesis to verify the proposed minimum phase inverter.

In microgrid application, multi-output converters are needed for different power requirements. These converters have higher power density and they require improved reliability due to multi-output system. In conventional multi-port system, several converters are used in parallel to achieve multiple outputs. In view of more number of conversion stages, such systems have poor performance and reduced overall efficiency. In order to overcome the problems associated with the conventional multi port system, in the thesis, two multi output converters are proposed. The proposed converters are capable of giving n number of ac outputs and single dc output which are suitable for

different load requirements. In one case, the proposed converter gives n number of ac outputs with same voltages and variable currents along with a dc output and in another case, the converter give n ac outputs with variable voltages and same current along with a dc output. The proposed converter modelling, analysis, and verifications are discussed in this thesis.

In this thesis, modified ZSIs topologies are also proposed for improved voltage gain without using additional passive components. The conventional ZSI has low voltage gain and to achieve high gain, converter needs to operate at a higher duty cycle. This leads to the lower value of modulation index and has poor ac output quality. The detailed operation of all the proposed ZSIs is presented in this thesis followed by modeling, PWM techniques, detailed comparisons, and cost analysis.

In this thesis, chapter 1 deals with the introduction of the high gain converters used in microgrid applications and state of the art of high gain converters. Minimum phase quadratic boost hybrid inverter is discussed in Chapter 2. Multi-output based quadratic topologies operation; modeling and simulation verification is given in Chapter 3. Proposed impedance-source inverter topologies are discussed in Chapter 4. Experimental verifications of all the proposed converters are given in Chapter 5. Finally, general conclusion about the work done and further research scope are discussed in Chapter 6.