

Contents

Abstract	v
List of Tables	xi
List of Figures	xiii
Nomenclature	xix
1 Introduction	1
1.1 Gain enhancement approaches in DC/DC converters	3
1.2 Impedance Source Converters	10
1.3 Objective	17
1.4 Structure of the thesis	17
2 Quasi-Impedance Source High gain Converter	19
2.1 Introduction	19
2.2 Proposed converter and its operation	20
2.2.1 Mode 1, ($0 < t < DT_s$)	21
2.2.2 Mode 2, ($DT_s < t < T_s$)	22
2.2.3 Voltage gain derivation	23
2.3 Parameter design consideration	24
2.3.1 Inductor design	24
2.3.2 Capacitor design	25
2.4 Voltage stress across components	25
2.5 Comparative analysis	25
2.6 Experiment results	29
2.7 Conclusion	32

3	Active Switched Quasi Z-source Converter	33
3.1	Introduction	33
3.2	Topological derivation of proposed converter-2 and its operation	34
3.2.1	Mode 1	35
3.2.2	Mode 2	36
3.3	Design guidelines	37
3.3.1	Inductor design	38
3.3.2	Capacitor design	38
3.4	Voltage and current stress of semiconductor devices	39
3.5	Dynamic analysis of proposed converter	41
3.6	Boost stage experimental validation	43
3.6.1	Boost stage closed loop validation	47
3.7	Extension to hybrid system	48
3.7.1	Operating modes	49
3.8	Steady state analysis	50
3.9	Simulation and experimental validation	51
3.9.1	Experimental results	53
3.10	Comparison with other existing topologies	55
3.11	Conclusion	57
4	Active Switched Inductor based Converter	59
4.1	Introduction	59
4.2	Proposed ASL derived converters	60
4.2.1	Operation	61
4.2.2	ASL derived proposed converter-4	62
4.2.3	Operation	63
4.2.4	Current stress on diodes and switches	67
4.3	Performance comparison with wide duty range based converter	68
4.3.1	Small signal analysis of Proposed converter	71
4.3.2	Experimental validation	73
4.3.3	Power loss analysis	79
4.3.4	Soft switching in proposed converter-4	81

4.4	Proposed interleaved converter	83
4.4.1	Operation	83
4.4.2	Experimental validation	86
4.4.3	Soft switching based ZVS operation	87
4.4.4	Conclusion	91
5	Triple-mode Flexible High gain Converter	93
5.1	Introduction	93
5.2	Proposed converter-5	94
5.2.1	Operating principle and its modes	94
5.2.2	DCM operation and boundary condition	98
5.3	Device stress and design equations	99
5.4	Comparison and analysis of converter	101
5.5	Experimental validation	104
5.6	Loss calculation	108
5.7	Conclusion	111
6	Conclusion and future work	113
6.1	Conclusion	113
6.2	Future work	114
	Bibliography	117
A	List of Publications	127
A.1	Journal papers	127
A.2	Conference papers	127