

Table of contents

List of Figures	IV
List of Tables	VIII
1. Introduction	1-5
1.1 General	1
1.2 State of The Art	2
1.3 Motivation	4
1.4 Thesis Organization	5
2. Principle Of Induction Melting & Survey of Power	
Topologies & Different Tuning Methods for PID	6-23
2.1 Introduction	6
2.2 Types of Electric Process Heating	7
2.3 Principle of Induction Melting	8
2.4 Electromagnetic Induction	9
2.5 Skin Effect	9
2.6 PWM Techniques	10
2.7 Resonant Topologies	12
2.7.1 Series or Parallel Loading	13
2.7.2 Fixed or Variable Frequency	13
2.7.3 Discontinuous Resonance	14
2.7.4 Zero Current Switch	14
2.7.5 Zero Voltage Switch	15
2.8 Survey of different tuning methods for PID	16
2.9 Summary	23
3. Design & Implementation of A Quasi-Resonant Converter	24-37
3.1 Introduction	24
3.2 Resonant Converter	25
3.3 Power System of Induction Melter	27
3.4 Half-bridge Series Resonant Converter	28
3.4.1 Main Power Circuit	29
3.4.2 Operation Theory	30
3.5 Quasi-resonant Converter	32
3.5.1 Main power circuit	32
3.5.2 Operating Concept	32

3.6 Simulation of Quasi-resonant Converter	34
3.7 Summary	37
4. Proposal & Implementation of Modified Quasi-Resonant Converter	38-45
4.1 Introduction	38
4.2 Modified Quasi Resonant Converter	38
4.2.1 Main Power Circuit	39
4.2.2 Operation Theory	39
4.3 Simulation of Modified Quasi-resonant Converter	40
4.4 Summary	45
5. Design And Implementation of Power Circuit	46-56
5.1 Introduction	46
5.2 Steps of Design of Tank Circuit	46
5.3 Summary	56
6. Development And Design of The Control Circuit for Quasi-Resonant Converter	57-74
6.1 Introduction	57
6.2 Control	57
6.3 Current Sensing Technology Overview	58
6.4 Micro-controller Board (AT89C51ED2)	61
6.5 Embedded controller (ARM-7) Board (LPC2478)	66
6.6 Coreless IGBT Gate Driver	67
6.7 New Generation Scale-2 IGBT-Driver Circuits	68
6.8 Summary	74
7. Software Implementation	75-98
7.1 Introduction	75
7.2 Low-level software for Micro-controller Board	75
7.2.1 Main program	75
7.2.2 Timer-0 Interrupt at 1ms	78
7.2.3 Timer-1 Interrupt for maximum on-cycle time	80
7.2.4 Timer-2 Interrupt at 40ms	81
7.2.5 Interrupt on external falling edge (generated by Load Tuning Circuit of Figure 6-7)	86
7.2.6 Serial port Interrupt	86

7.3 High-level software for Embedded controller (ARM-7) Board	90
7.3.1 Graphical User Interface	90
7.3.2 Main program (MAIN.C)	93
7.3.3 Interrupt Routines (IRQ1.C)	95
7.3.4 Serial Port Routines (UART.C)	98
7.4 Summary	98
8. Experimental Verification	99-107
8.1 Introduction	99
8.2 Experimental System	99
8.3 Protection Considerations	103
8.4 Experimental Results	103
8.5 Summary	107
9. Conclusion & Future Scope	108-111
9.1 General	108
9.2 Summary of Important Findings	108
9.3 Scope for Further Research	111
10. Bibliography	112-119
Appendix A: Using Development Tools	120-127
A.1 Programming AT89C51ED2	120
A.2 Keil Real View Project Creation	121
A.3 Eagle Schematic Design	123
A.3 Datasheet of IGBT	124
Appendix B: Photo Gallery	128-137