			9	
List of Figures	,			

.

Figu	re Name of Figure	Page
No.		No.
2-1a	Equivalent circuit of a transformer	8
2-1b	Secondary short	8
2-1c	Basics of Induction Melting	8
2-2	Waveform of a Switching Device	11
2-3	Basic Resonant Converter	13
2-4	Zero-current switch - topology and waveforms	15
2-5	Zero-voltage switch - topology and waveforms	15
2-6	A SIMULINK setup for Example 1	21
2-7	Oscillation captured from scope	21
2-8	Step response from PID values given by ZNFD method	22
2-9	How a point on Nyquist curve is moved with PID control	23
3-1	Operating Principle	24
3-2a	Series Resonant	25
3-2b	Parallel Resonant	25
3-3	Frequency Curve	27
3-4	Power System Using Half-bridge Series Resonant Converter	28
3-5	Main Power Circuit	29
3-6	Equivalent Circuit	29
3-7	Equivalent of Main Power Circuit	30
3-8	Waveforms of Main Power Circuit	31
3-9	Power Circuit of Quasi-resonant Converter	32
3-10	Equivalent Circuit	33
3-11	Waveforms of Main Power Circuit	33
3-12	Simulation of Quasi-resonant converter	35
3-13	Simulation Result of Inductor Current	36
4-1	Power Circuit of Modified Quasi-resonant Converter	38

4-2	Equivalent Circuit	39
4-3	Waveforms of Main Power Circuit	39
4-4	Simulink Block of Quasi-resonant converter	41
4-5	Simulation Result of Inductor Current	42
4-6	Simulation Result of IGBT Current	43
4-7	Simulation Result of voltage across IGBT	44
5-1	Tank Capacitor Bank	47
5-2	Modified Tank Capacitor Bank	48
5-3	Tank Inductor	49
5-4	L-C Tank Circuit	50
5-5	Three phase transformer	51
5-6	Three Phase Bridge Rectifier	52
5-7	Filter Choke	52
5-8	Set of Output Characteristics for two IGBT's with different Saturation Voltages	54
5-9	The TC of the Set of Output Characteristic Curves	55
5-11	RCD Snubber	56
6-1	Control Scheme	57
6-2	Variable Load	58
6-3	Representation of the Hall effect and its electrical parameters	59
6-4	Basic Topology of Open Loop Hall Effect Current Sensor	59
6-5	Basic Topology of Close Loop Hall Effect Current Sensor	60
6-6	Hall Effect Current Sensor Panel Mounting Type HT300M	61
6-7	Load Tuning and Over Current Protection Circuit	62
6-8	Waveform of Load Tuning Circuit	63
6-9	Micro-controller Circuit	64
6-10	Measurement of DC-Link Voltage & Current	65
6-11	Measurement of Crucible Temperature	65
6-12a	ARM-7 control board (top part)	66
6-12b	ARM-7 control board (bottom part)	67
6-13	Block diagram of the coreless gate drive system	67
6-14	Basic Schematic of the gate drive board with 2SC0435T driver	68

6-15	Turn-on characteristic of an IGBT	69
6-16	Typical characteristic at IGBT turn-off	69
6-17	Principle of an IGBT driver with Active Clamping	70
6-18	Principle of an IGBT driver with Advanced Active Clamping	71
6-19	Principle of a central driver	71
6-20	Principle of driving parallel connected IGBTs with individual drivers	71
6-21	Electrical characteristics of 2SC0435T	72
6-22	Final Schematic of the gate drive board with 2SC0435T driver	73
7-1	Monitor Page of GUI	90
7.2	Setup Page of GUI	91
7-3	Snapshot of Melter Project in Keil Real View	92
7-4	Closed Loop System with PID controller	95
7.5	PID controller schematic	95
8-1	Micro-controller (AT89C51ED2) Board	99
8-2	Gate firing section of Micro-controller Board	100
8-3	IGBT driver board placed near IGBT assy.	100
8- 4	Comparator section of Micro-controller Board	101
8-5	CS5460(ADC) section of Micro-controller Board	101
8-6	ARM-7 controller Board	102
8-7	Gate drive board with 2SC0435T driver	102
8-8	Copper work pieces kept into crucible	103
8-9	Gate Pulse v/s Tank current	104
8-10	Gate Pulse v/s DC-Link current	105
8-11	Gate Pulse v/s DC-Link voltage	105
8-12	DC-Link Current	106
8-13	Power Factor Reading 0.999	106
8-14	Melted work pieces	107
A-1	Crystal Programmer	120
A-2	Programming window	121
A-3	New Project wizard	121
A-4	Configuration wizard	122

A-5	Project Creation with Different groups	122
A-6	Schematic Design in Eagle 5.4	123
A-7	Datasheet of FZ600R12KE4 IGBT	124
B-1	LPC2478 OEM Board	128
B-2	Thermocouple Mounting	129
B-3	Meters & DSO	129
B-4	LCD display of Mirco-controller Board (POWER-OFF)	130
B-5	LCD display of Mirco-controller Board (POWER-ON)	130
B-6	Title Screen of Embedded Controller	131
B-7	Monitor Screen of Embedded Controller	131
B-8	Screen of Embedded Controller showing START of Melter Power	132
B-9	Screen of Embedded Controller for going into Parameter Menu	132
B-10	Parameter Screen of Embedded Controller	133
B-11	Snapshot of D.S.O. showing Tank Current	133
B-12	Whole setup for metering	134
B-13	Prototype Model of Induction Melter	134
B-14	Testing of Induction Melter in Progress-1	135
B-15	Testing of Induction Melter in Progress-2	135
B-16	Work Pieces of Copper	136
B-17	Work Pieces in Crucible	136
B-18	Insertion of long copper piece to show effect of load inductance changes	137
B-19	Melted work pieces	137

.

.

VII

•