

Contents

1	Introduction	1
1.1	Wearable Devices and Battery Technology in IoTs	1
1.2	Energy Harvesting and Autonomous Systems	3
2	Energy Harvesting Sources, Models, and Circuits	7
2.1	Energy Harvesters	7
2.1.1	Thermoelectric Generators	7
2.1.2	Piezoelectric Harvesters	12
2.1.3	RF Harvesting	23
2.1.4	Solar Harvesting	30
2.2	Power Conversion Circuits	32
2.2.1	Linear Regulators	33
2.2.2	Switched-Capacitor Circuit	33
2.2.3	Switching Converters	35
3	Interface Circuits for Thermoelectric Generator	37
3.1	Inductor-Based DC–DC Converters	37
3.1.1	An Asynchronous Inductor-Based DC–DC Converter	37
3.1.2	A Synchronous Inductor-Based DC–DC Converter	39
3.2	Design of the Synchronous Inductor-Based Boost Converter	40
3.2.1	Losses in the Inductor-Based Boost Converter	40
3.2.2	Control Circuits for Inductor-Based Converter	41
3.2.3	Power Conversion Architectures	44
3.2.4	System Robustness	45
4	Zero Crossing Switching Control for L-Based DC–DC Converters	47
4.1	Background and Prior Work	47
4.2	Example of ZCS Control Circuit	51
4.2.1	Coarse/Fine ZCS Techniques	51
4.3	Measurement Results	54

5 Polarity Mechanism for Thermoelectric Harvester 61

5.1 Prior Work in TEG Polarity Mechanism 61

5.2 Example of Auto-Polarity Control Circuit 63

5.2.1 Measurement Results of Auto-Polarity Circuits 70

6 Energy Combiner and Power Manager for Multi-Source Energy Harvesting 81

6.1 Reported Techniques in Energy Combiner Techniques 81

6.2 Power Manager Implementation for Multi-Source Energy Harvesting 84

6.2.1 Biomedical Processor 85

6.2.2 Power Manager 86

6.2.3 Sleep Mode Operation 88

References 91

Index 97

Energy Harvesting for Self-Powered Wearable Devices

Alhawari, M.; Mohammad, B.; Saleh, H.; Ismail, M.

2018, XII, 99 p. 89 illus., 57 illus. in color., Hardcover

ISBN: 978-3-319-62577-5