Development of A Novel Single Phase Non-isolated AC-DC Buck-Boost Converter

by

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MASTER OF SCIENCE

IN

ELECTRICAL AND ELECTRONIC ENGINEERING

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January, 2021

CERTIFICATE OF APPROVAL

The thesis entitled **"Development of A Novel Single Phase Non-isolated AC-DC Buck-Boost Converter"** submitted by Istiak Ahmed, Student No. 152620 of Academic Year 2016-17 has been found as satisfactory and accepted as partial fulfillment of the requirement for the Degree of MASTER OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING on January 03, 2021.

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Dedicated to my dear parents

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LIST OF ABBREVIATIONS

PFC	Power Factor Correction
SMPS	Switch Mode Power Supply
SEPIC	Single-ended Primary-inductor Converter
THD	Total Harmonic Distortion
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
IGBT	Insulated Gate Bipolar Transistor
IEEE	Institute of Electrical and Electronics Engineers
PF	Power Factor
PWM	Pulse Width Modulation
PI	Proportional- Integral

Acknowledgement

First, I offer my gratitude to the Almighty ALLAH Subhanahu Wa Ta'la for giving me the capability to do this work with good health.

I am very much grateful to my research supervisor, Professor Dr. Golam Sarowar for his support and guidance throughout the course of this work. He has created a research environment for which I was able to explore many ideas without constraint. I have gained a wealth of knowledge and experience in science and engineering through his direction that is beyond value to my future endeavors.

As I am currently doing a job, the journey was not easy for me to complete my thesis work unless I got continuous support from my family. I am thankful to my family members especially to my parents for their continuous support throughout my entire academic life. I would also like to acknowledge the support from some of my friends who have been a constant source of inspiration all along this work.

Abstract

Switched mode power converters have been studied broadly and used in industrial products. The classification comes as Buck, Boost and Buck-Boost for the basic topology in which single inductor is presented and also Cuk, Sepic and Zeta for higher order topology in which two inductors are presented in the circuit. A new topology of Single –Phase AC-DC Buck-Boost converter is presented in this thesis book. Conventional AC-DC converters use full-wave bridge rectifier that has the drawbacks like pulsating input current, high electromagnetic interference (EMI), high crest factor, low input power factor, low efficiency, and harmonic pollution at power system etc. Instead of using a single phase rectifier followed by DC-DC converter, two inductors and two capacitors are used with suitable combination of switch and diodes. The proposed converter provides better conversion efficiency than the conventional converter throughout the variation of duty cycle. Input power factor of the proposed converter is less than the conventional converter for lower and higher duty cycles. By using suitable feedback control in closed loop system, the problem of low input power factor has been corrected. The proposed converter with PFC controller provides very high input power factor (0.994) which is almost close to unity. The proposed converter has lesser total harmonic distortion (THD) of input current in comparison with the conventional one for higher duty cycles but for lower duty cycles the conventional converter shows better performance Again, using the feedback controller, the THD of input current is kept close to IEEE Standards for the proposed converter. The proposed converter with feedback controller provides higher conversion efficiency, reduced total harmonic distortion (THD) of input current and quality power factor. Dynamic response of the proposed converter has also been observed. The proposed converter can maintain a desired level of output voltage with sudden changes in load. Analysis and simulation results of the circuit are obtained using software simulation. The main advantage of this new AC-DC converter is it’s superior efficiency over conventional AC-DC converters.