International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: VI Month of publication: June 2023

DOI: https://doi.org/10.22214/ijraset.2023.53868

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

High Gain Modified Based on Switched Inductor

Akshaya Meera. G[1], D. Ashokararaju[2]
[1]PG Scholar, Power Electronics and Driver Government College of Engineering, Salem
[2]Associate Professor, Dept of Electrical and Electronic Engineering, Government College of Engineering Salem

Abstract: The proposed work represents the Modified boost converter is able to regulate the output voltage and the choice of second inductor can give its current as positive and whereas for boost increases in the voltage will not able to regulate the output voltage. It has low semiconductor device voltage stress and switch usage factor is high. A power with 125 W is developed with a 20V input voltage and yields 222 V output voltage and the outcomes are approved through recreation utilizing MATLAB/SIMULINK/MODEL.
Keywords: High Gain DC-DC Converter, Modified Boost Converter, Switched Inductor

I. INTRODUCTION

A modified boost converter is a type of DC-DC power converter that allows for voltage step-up and regulation. It is an improved version of the conventional boost converter, designed to provide better efficiency, reduced size, and improved performance.The boost converter is commonly used in various applications, such as renewable energy systems, battery charging, electric vehicles, and portable electronic devices. It works by converting a lower input voltage to a higher output voltage using an inductor, a diode, a capacitor, and a power switch (typically a transistor).The modified boost converter incorporates certain enhancements and additional control features to overcome some limitations of the conventional boost converter. Here are a few key features and improvements:

A. High Efficiency

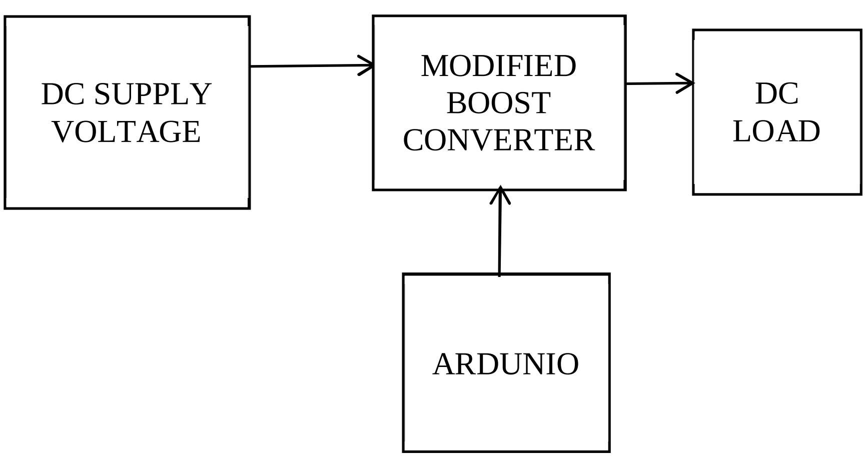
The modified boost converter aims to achieve higher efficiency by minimizing power losses during the conversion process. This is achieved through the use of advanced-power semiconductor devices with lower conduction and switching losses.

B. Improved control Techniques

The modified boost converter employs advanced control techniques, such as pulse width modulation (PWM) and feedback loops, regulate the output voltage accurately. These control techniques help maintain a stable and constant output voltage despite variations in the input voltage and load conditions. Reduced size and weight: The modified boost converter often incorporates advanced components and designs that allow for a more compact and lightweight converter. This is particularly beneficial applications where space is limited or weight is a critical factor, such as in portable electronic devices or electric vehicles.

II. BLOCK DIAGRAM MODIFED BOOST CONVERTER

.



International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

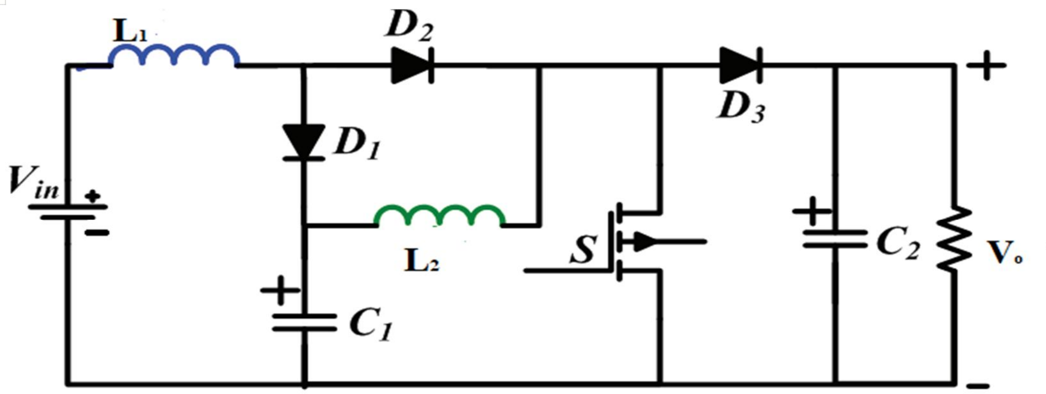


Fig (2) Modified boost converter diagram

III. SWITCHED INDUCTOR

A Switched inductor modified boost converter ,also known as modified boost converter with switched inductor, a power electronics circuit used for DC-DC voltage conversion.It is modification of the traditional boost converter ,which is widely used for stepping up voltage level.

In a modified boost converter with a switched inductor ,an additional inductor is introduced into the circuit. This inductor is connected in series with main boost inductor and is switched between two states on and off.

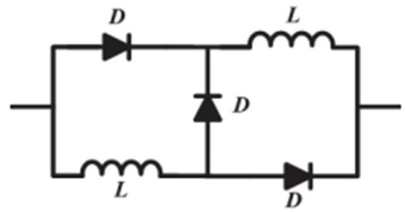


Fig (3) Switched inductor

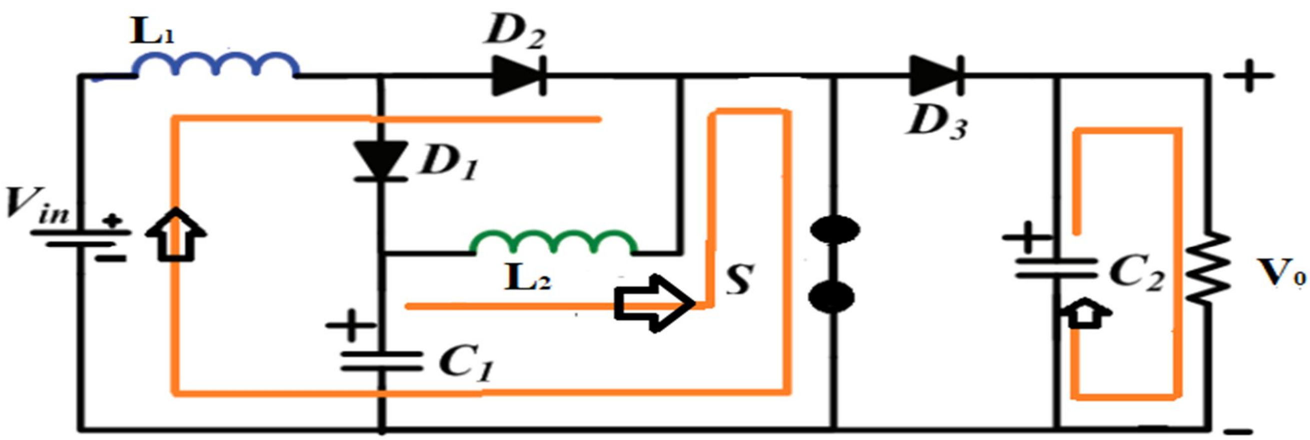
IV. MODIFIED BOOST CONVERTR MODES OF OPERATION

A. Modes Of Operation Modified Boost Conveter

1) Switch is Off (MODE1)

In this mode of operation, Diode D2 is in forward bias condition due to the input supply Vin .Diodes D1 and D2 are not conducting due to reverse bias condition ensure due to capacitors C1 and C2 respectively

In this circuit diagram assume **voltage across the inductor** mosfet switch is closed .



International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

-Vin+VL1=0

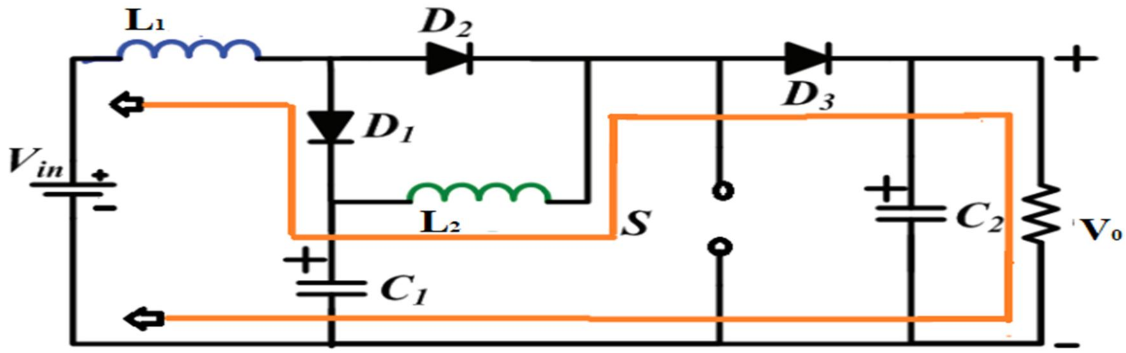
Vin=VL2 (1)

-VC1+VL2 =0

VC1=VL2 (2)

2) Switch Open (MODE -2)

The inductors L1 and L2 are charged from input supply Vin and capacitor C1 respectively. The current flowing through the inductor is rising and slope of capacitor voltage is decreasing due to its discharging nature Capacitor C2 is discharged the load and L2 are demagnetized along with input supply Vin into capacitor C2 through diode D3. In mode switch open, two inductor are demagnetized or current flowing through inductor L1 and L2 is decreasing as . The two capacitor C1, and C2 are charged from inductor L1, L2 and input supply Vin. The current flowing through Capacitor C1 and C2 is increasing the circuit diagram



-Vin+VL1+VC1=0

- Vin+VL1+VLY+ V0=0 (3)

VL1= Vin-VC1

VL1+VL2=Vin -VO

VL2=Vin -Vo +VC1

Voltage self balanced mode

VL1D+VL1(1-D)=0

Vin+(VL1-VC1)(1-D)=0

VC1=Vin/(1-D) (4)

VL1D +(VC1-VO)(1-D (5)

VL1D +VC1(1-D)-VO(1-D)=0

VC1=VO(1-D) (6) Combine equations 5 and 6

$$V_{0}=V_{in}/(1-D)^2$$

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

B. Design Of Modified Boost Converter

The inductor (L1) is selected as per the formula given

L1=Vin/△IL1f (7)

Rate of change of inductor I1

2)

2) ILX= IO/(1-D) ^{2} (8)

2)

2) The inductor (L2) is selected as per the formula given below

2)

2) L2=Vin.D/(1-D)△IL2 (9)

2) Rate of change Inductor current I2

2) IY= Io/(1-D) (10)

2) To find the maximum inductor L1 and L2 current is given

2) I1(max)= △IL1/2+IL1 (11)

2)

2) I2(max)= I2+△I2/2 (12)

2)

2) To find minimum inductor current L1 is given

2) IL1(min)= △IL1/2-I1 (13)

2)

2) To find minimum inductor current LY is given

2)

2) IL2(min)=ILY-△IL2/2 (14)

The capacitor (C1) is selected as per the formula given below

C1 = IO*D/f(1-D) △VC1 (15)

△VC1 if we assume the ripple current of 2% of VC1

VC1= Vin/(1-D) (16)

The capacitor C2 is selected as per the formula given below

C2=IDO/f△VC2 (17)

△VC2 if we assume the ripple current of 2% of VC2

VC2= Vin /$(1-D)^2$ (18)

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

V. SIMULATION RESULT-TABLE 1

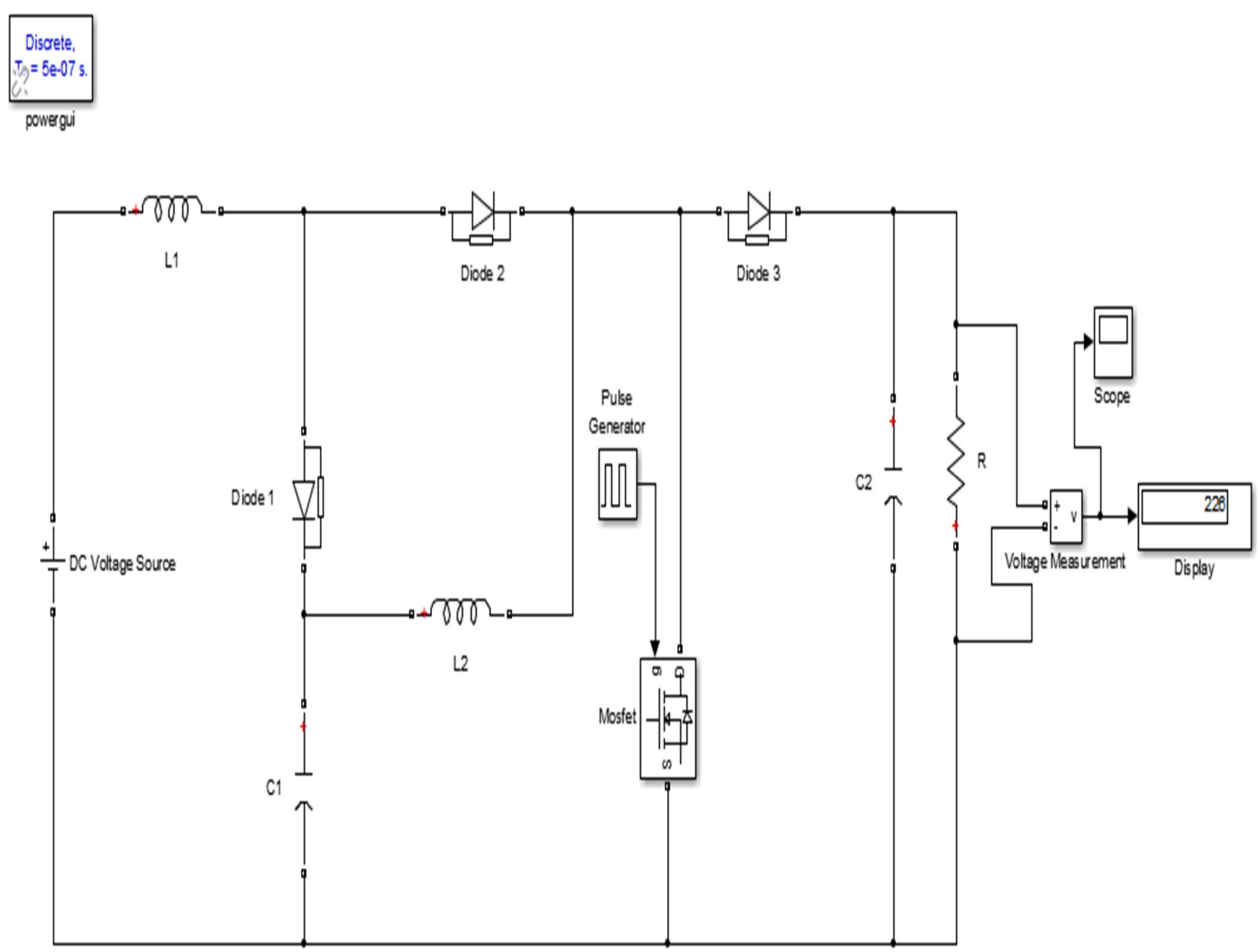
A. Specification Of High Gain Dc-Dc Boost Converter

INPUT VOLTAGE	20V
OUPUT VOLTAGE	222.22
OUTPUT POWER	125W
RIPPLE VOLTAGE	20%
RIPPLE CURRENT	2%
SWITCHING FREQUENCYB	40kHZ
DUTY CYCLE	70%

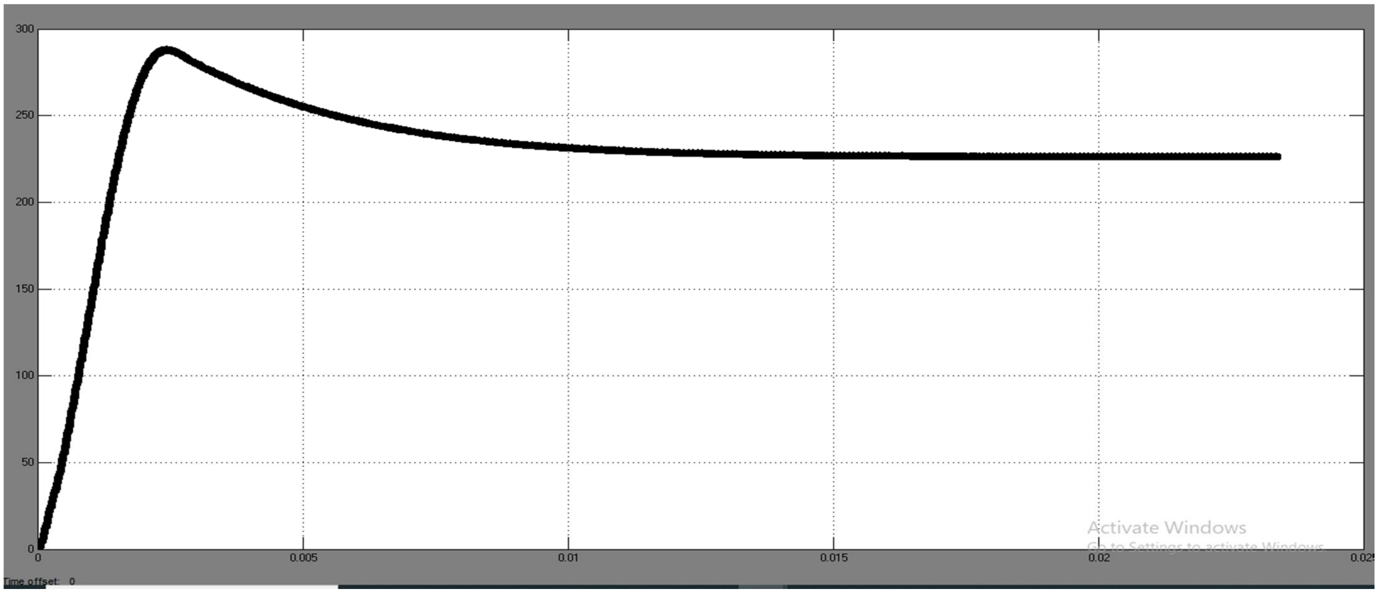
VI. MATLAB STIMULATION OF MODIFIED BOOST CONVERTER

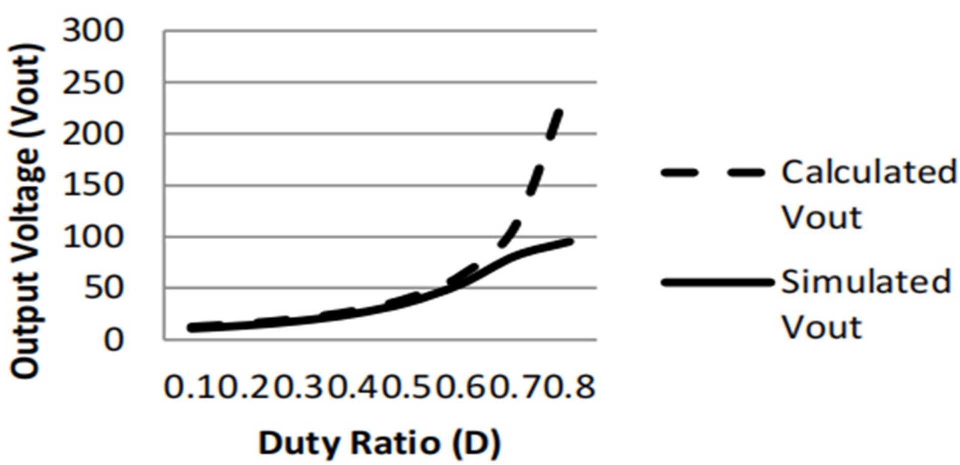
A. Experimental Results Matlab / Simulation Waveform

If Vs= 20v ,dutycycle =0.7 then the output voltage is given at 222.22 for the duty cycle 0.7 whereas the simulation output is 222 for the same input voltage .The simulation output of Modified boost converter



B. Voltage Waveform High Gain Dc-Dc Converter Boost Converter





Calculated and Simulated Output Voltage for Modified Boost converter

VII. CONCLUSION

The Modified boost converter achieves high power conversion efficiency , minimizing power loss and enhancing overall system efficiency . This efficiency is essential for reducing energy consumption, improving performance ,and prolonging the lifespan of an electronic system.The quadratic boost converter DC-DC converter that efficiently steps up voltage levels using a quadratic relationship between the input and output voltages .It offers several advantages, including a wider voltage conversion range, high power conversion efficiency and simple circuit design.

The Modified boost converter finds application in diverse fields such as renewable energy systems, electric vehicles ,and a high - power electronic devices.Its play a crucial role in stepping up the voltage generated by the renewable sources for grid intergration or battery charging.In electric vehicles ,it enables efficient power delivery and allows for the use of smaller and lighter components .Moreover, essential ,in high power electronic devices ,the quadratic boost converter is achieve the necessary high voltage level.By controlling switch and optimizing the energy transfer process, the quadratic boost converter achieves high power conversion efficiency,minimizing power loss and enhancing overall system efficiency. This efficiency is for reducing energy consumption ,improving performance , and prolonging the lifespan of electronic system .

Furthermore, the simplicity of circuit design and control implementation in the quadratic boost converter facilities manufacturing process ,reduces cost and enhances reliability.

In summary ,the quadratic boost converter is a valuable component in power electronics ,providing efficient voltage step -up capabilities , wide range conversion range ,high efficiency ,and simplicity in design .

Its versatility and benefits make it a key player in various industries ,contributing to the development of a sustainable energy system and high -performance electronic devices.

REFERENCES

[1] M. Forouzesh, Y. P. Siwakoti, S. A. Gorji, F. Blaabjerg and B. Lehman, "Step-Up DC–DC Converters: A Comprehensive Review of Voltage Boosting Techniques, Topologies, and Applications," in IEEE Transactions on Power Electronics, vol. 32, no. 12, pp. 9143-9178, 06 March 2017.

[2] Transactions on Industrial Electronics, Vol. 46, no. 7, pp. 2025-2034, Sep. 2010.Armani, Divya&Krishnasamy, VijayakumA. A. Fardoun, E. H. Ismail, "Ultra step-up DC-DC converter with reduced switch stress," IEEE Tran&Gathering, R. (2016). "Non-isolated high gain DC-DC converter by quadratic boost converter and voltage multiplier cell". Ainu Shams Engineering Journal. 10.1016/j.asej.2016.09.007.

[3] A. Fardoun, E. H. Ismail, "Ultra step-up DC-DC converter with reduced switch stress," IEEE Transactions on Industrial Electronics, Vol. 46, no. 7, pp. 2025-2034, Sep. 2010.Pranshu Agarwal, Sarajevo Kumar Singh" A Modular Magnetically Coupled Quadratic Boost Converter for Micro source Applications" in IEEE at 7th IET International Conference on Power Electronics, Machines and Drives (PEMD 2014)

[4] M. S. Bhaskar, P. Sanjeevikumar, F. Blaabjerg, V. Fedák, M. Cernat and R. M. Karakul, "Non-isolated and non-inverting Cock croft-Walton multiplier based hybrid 2Nx interleaved boost converter for renewable energy applications," Conf. Proc., IEEE Intl. Power Electronics and Motion Control Conf. (PEMC), Varna, pp. 146-151. 25-28 Sept. 2016 .

[5] Pandav Kiran Maroti, P.Sanjeevikumar, Frede Blaabjerg, Viliam Fedák, Pierluigi Siano, Vigna K. Chandrasekhar, "A Novel Switched Inductor Configuration for Modified SEPIC DC-to-DC Converter for Renewable Energy Application", Conf. Proc., 3rd IEEE Conf. on Energy Conversion, IEEE-CENCON'17, Kuala Lumpur (Malaysia).

[6] Pandav Kiran Maroti, M. S. Bhaskar, P. Sanjeevikumar, Frede Blaabjerg, Viliam Fedák, "A High Gain Modified SEPIC DC-to-DC Boost Converter Renewable Energy Application" Conf. Proc., 3rd IEEE Conference on Energy Conversion, IEEE-CENCON'17, Kuala Lumpur (Malaysia), 10/2017.

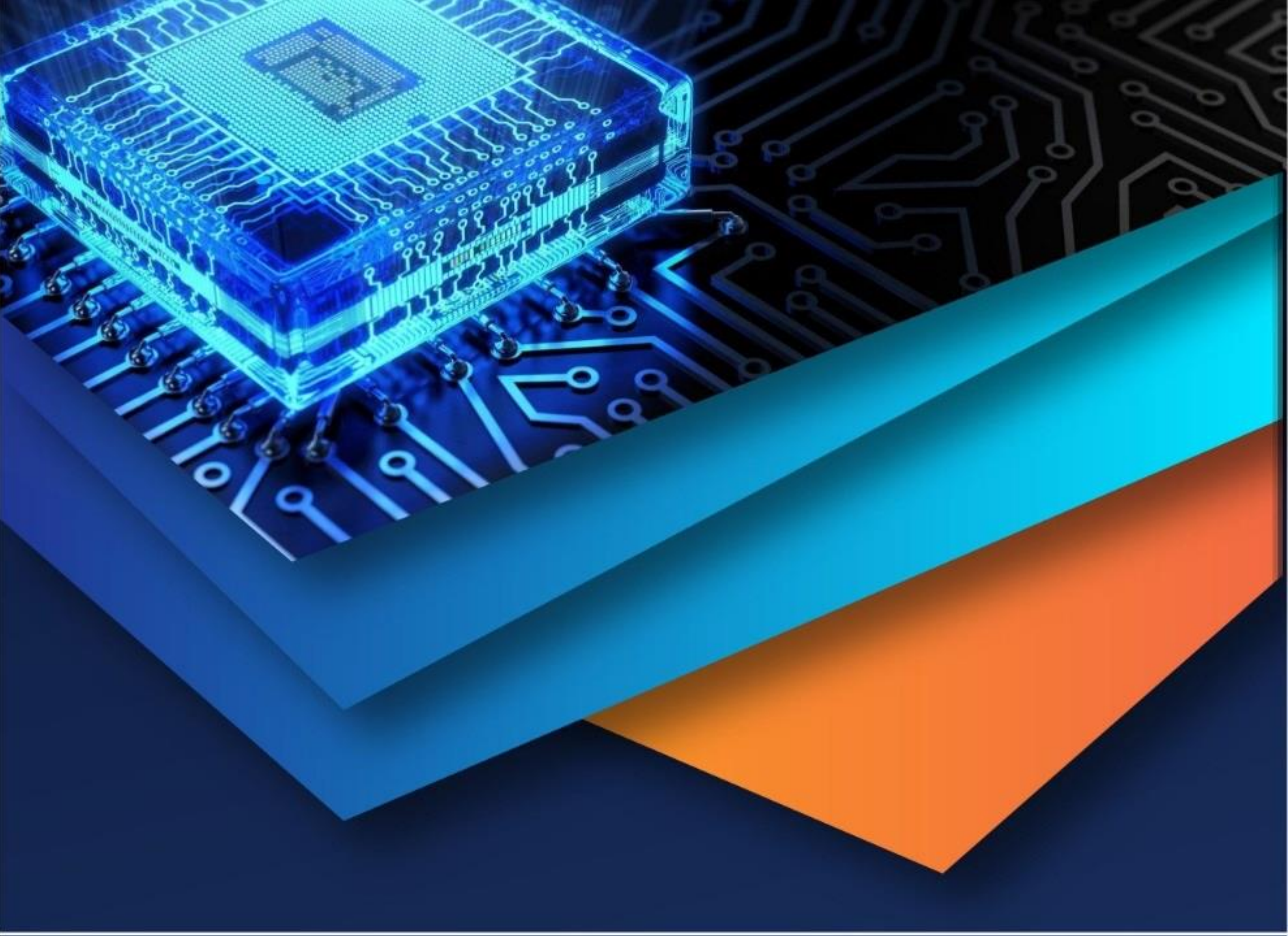
[7] Priya P, Basha SG, Niranjan VSV, Seyezhai R. Investigation of the MOSFET based Quadratic Boost Converter for Photovoltaic Applications. IJPERA. 2016 Oct; 1(3):26–9.

[8] Dhanasekaran R, Arun Prasath T. Performance comparison of solar power using Quadratic Boost Converter with coupled inductor. International Conference on Advanced Communication Control and Computing Technologies (ICACCCT); 2014 May. p. 376–8.

[9] R. J.Wai and R. Y. Duan, "High step-up converter with coupled inductor," IEEE Trans. Power Electron., vol. 20, no. 5, pp. 10251035, Sep. 2005.

[10] Gu B, Dominic J, Lai JS, Zhao Z, Liu C. High boost ratio hybrid transformer DC-DC converter for photovoltaic module applications. IEEE Trans Power Electron 2013;28(4):2048–58.

.



10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

TOGETHER WE REACH THE GOAL

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY