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A New Approach of Modeling and Simulation of High Frequency Boost Convertor

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ABSTRACT: Boost converters are very important circuits for cutting-edge devices, specifically battery operated incorporated circuits. This kind of converter allows for small voltages, such as those furnished by means of a battery, to be converted into larger voltage greater suitable for riding integrated circuits. Two regions of operation are explored known as zero to 180 phases and 180 to 360 conduction Mode. Each region is analyzed in phrases of DC and small-signal performance. Control troubles with each are in comparison and diverse mistakes amplifier architectures explored. A approach to optimize these amplifier architectures is also explored by using method of different DC to DC topology. Finally, stability measurement strategies for enhance converters are explored and compared so that you can gauge the viability of each approach. This painting has been giving an explanation for with the help of Matlab/Simulation2013a. This work attempts to cope with this trouble, by means of in search of to reap higher energy conversion efficiency under sub- optimal situations. In this thesis, stand-on my own photovoltaic structures the usage of DC-DC improve converters are considered.

An interleaved boost converter with switch adaptive control scheme is designed to maximize system efficiency over a wider range of real-time operating situations and with unique load conditions without incurring giant extra value.

KEYWORDS: boost convertor, DC, voltage, amplifier, math lab, simulation.

I. INTRODUCTION

1.1 Introduction

Modern electronic structures necessitate excessive pleasant small Light weight reliable& efficient power supplies. Linear Power regulators whose object of operation is depending on a voltage or current divider are in efficient. Highest-frequency electronic power processors are utilized in DC-DC power conversion

Functions of dc-dc converters are:-

a. Convert a dc I/p voltage V in to a dc O/p voltage Vo.
b. Regulate the dc o/p voltage against load &line Variations.
c. Reduce the ac voltage ripple on the dc output voltage below the required level.
d. Give isolation amid the I/p source & the load (isolation is not always required).
e. Protect the supplied system & the input source from electromagnetic interference (EMI).
f. Satisfy various international & national safety standards.

Boost converter review

There are two classes of DC – DC converters: Isolated & Non-Isolated DC – DC converters. Isolated DC – DC converters as the name implies electrically isolate the O/p from the I/p utilizing a high frequency transformer. The transformer's turns ratio dictates the relationship amid the input & output voltage. Through having various secondary windings isolated converters are able to provide multiple levels of output voltages. The size of the transformer usually dictates the size of isolated converter. Hence they generally are large in size. On the other hand the Non- Isolated

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topologies can vary the dc output voltage &provide different level of output voltages without use of transformer & require fewer components to implement. Boost converter is also called as the step-up converter. It is one of the well-known topology in the area of power electronics &like any other DC – DC converters it aims to achieve high efficiency conversion. The reality of boost converter relies on the discovery of semiconductor switches. These switches are much faster &reliable than other switches such as vacuum tubes & electromechanical relays. The semiconductor switches are able to control at high frequency from about 200 kHz to as high as 2 MHz's. The frequency of Boost converters has an inverse relationship with the size of the magnetic components. Therefore having a high switching frequency is beneficial to reduction the size of the converter.

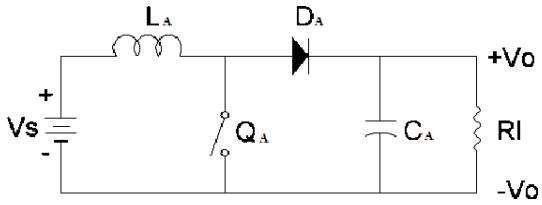

Fig -1.1 Boost converter

The proposed Boost Converter is a way to create a more efficient step up converter while at the same time decreasing the strain seen on a basic boost converter. Just another topologies of DC– DC converters. Boost Converter of Two-Phase analyzes semiconductor switches as the foundation of its operation. Semiconductor switches have fast turn on &off times &low on resistances which help to decrease losses during switching & conduction. Two-Phase Boost converter is essentially two boost converters located in parallel sharing the same input & output as shown in Figure. In principle it does the similar thing as a Boost converter which is stepping up the fixed dc voltage input. However unlike paralleled boosts the two phases in the proposed two-phase boost will never draw input current at the same time rather the path alternates between the first &second phase. So all paths only carry half of the o/p power & hence half the strain compared to a single.

II. LITERATURE REVIEW

Denis de Castro Pereira, Wesley Josias de Paula [1]:- The fundamental attention in dc–dc conversion is regularly associated with excessive efficiency, diminish stresses regarding semiconductors, lowest value, robustness and simplicity of the include topologies. In the previous few years, immoderate-step-up non-remote dc–dc converters have turn out to be pretty famous because of its huge applicability, specifically thinking about that dc–ac converters need to be commonly furnished with excessive dc voltages. The traditional non-isolated boost converter is the most popular topology for this reason, despite the fact that the conversion efficiency is restricted at high responsibility cycle values. In series to triumph over such drawback and improve the conversion ratio, derived topologies can be discovered in several publications as feasible answers for the aforementioned programs. In this context, this present intends to categorize and assessment a number of the most important non-remote enhance- primarily based dc–dc converters. While many systems exist, they may be essentially labeled as converters with and without wide conversion ratio. Sure of the predominant blessings and weaknesses concerning the existing approaches are also discussed. Finally, a proper comparison is set up a few of the most considerable converters regarding the voltage stress throughout the semiconductor factor, variety of additives and static gain.

Xuefeng Hu and Chunying Gong [2]:-The highest-voltage gain converter is extensively employed in various industry applications, consisting of photovoltaic structures, electric vehicles, and excessive- intensity discharge lamps and fuel cell systems. This paper defines a unique particular-switch highest step-up non-isolated dc–dc converter integrating coupled inductor within extended voltage double cell and diode–capacitor techniques. The define

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converter achieves extraordinarily large voltage conversion ratio with appropriate obligation cycle and reduction of voltage pressure on the power gadgets. Moreover, the strength stored in energy inductance of coupled inductor is effectively recycled to the o/p, and the voltage double cellular also operates as a reformative clamping circuit, lessening the problematic of capacity resonance amid the leakage inductance and the junction capacitor of o/p diode. These features make it likely to design a compact circuit with high static gain and high efficiency for industry applications. In addition, the unexpected highest-pulsed i/p modern-day inside the converter with coupled inductor is reduced. The operating ideas and the consistent state study of the define converter are define in brief. Lastly, a prototype circuit is applied with the research laboratory to confirm the proposed converter performance.

Fellipe S. Garcia [3]:- The Interleaved Double Dual Boost is a non-insulated, step-up DC-DC converter capable of excessive voltage gain and suitable to excessive- power applications. In this paper, the modeling and control design of this converter, valid for an arbitrary number of stages, is offered. The developed technique is then applied to a six-phase Interleaved Double Dual Boost and experimental effects are obtained with a prototype running with enter voltage of 60V, output voltage of 360V and with nominal output power of 2.2 kW. The applications of this converter include electrical vehicles and renewable energy conversion.

Wuhu a Li, Xiangninghe[4]:-The PV grid-linked power system within the residential usage sis turning into a rapid increasing phase inside the PV market because of the shortage of the fossil fuel energy and the good environmental pollution. A newest research trend in the residential era device is to employ the PV parallel connected configuration in preference to the collection- linked configuration to satisfy the safety requirements and to make full use of the PV generated power. How to acquire high-step-up, low-cost, and high-performance dc/dc conversion is the principal consideration because of the low PV output voltage with the parallel-linked shape. The limitations of the conventional increase converters in those programs are analyzed. Then, most of the topologies with highest-step-up, lowest-price, and highest-efficiency performance are covered and classified into several categories. Furthermore, a widespread conceptual circuit for excessive-step-up, lowest-value, and highest performance dc/dc conversion is proposed to derive the following generation topologies for the PV grid-linked power system. Finally, the fundamental challenges of excessive-step-up, lowest-price, and excessive performance dc/dc converters are summarized. This paper would really like to make a clear photo on the overall regulation and framework for the next-generation non isolated high-step-up dc/dc converters

Ping Yang, JianpingXu, Guohua Zhou, Shiyu Zhang [5]:- In this paper, a newest quadratic raise converter is define, Compared with the conventional quadratic boost converter. The newest quadratic boost converter employs an extra capacitor-inductor-diode (CLD) cell involving of an inductor, two diodes and two capacitors. The quadratic enhance converter with CLD cellular provided on this paper indicates an improvement of the voltage step-up ratio over the traditional quadratic raise converter and raise converter. So, it's well suitable for extreme highest voltage step-up ratio usage. The quadratic boost converter with CLD cell also shows a significant improvement in reduced voltage stresses of switch and diodes over the conventional quadratic boost converter and boost converter. The experimental outcomes of the define converter have been presented to verify the analysis results.

XiaomingGu, YileiGu, Lijun Hang, XiehuaWu, Zhengyu Lu [6]:- Paper presents a new topology named ZVS resonant reset dual switch forward DC-DC converter, which, compared with resonant reset single switch forward DC-DC converter, maintains the advantage that duty cycle ran be more than 5O%, at the same time disadvantage of high voltage stress for main switches and low eminency are overcome. In addition, soft switching is achieved for all switches of the presented topology. Therefore, this proposed topology could be very attractive for high input, wide range and excessive eminency packages. In this paper, the object and feature of this topology are study in brief. Lastly, the advantages mentioned above are verified by experimental result.

Yungtaek Jang, Milan M. Jovanovic [7]:- A newest, two-inductor, interleaved energy-issue corrected (PFC) boost

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converter that well-known shows voltage-double feature while it operates with a responsibility cycle greater than 0.5 is delivered. The voltage-double feature of the define converter makes it quite suitable for ordinary-line (ninety–264 RMS) PFC programs. Because the proposed PFC boost rectifier operates as a voltage double at lowest line, its low-line variety efficiency is considerably superior in comparison to that of its traditional counterpart. The overall performance of the proposed PFC rectifier became evaluated on an experimental 1.Three- kW commonplace-line PFC prototype. Enhance converters limits their packages in excessive step-up.

III. BOOS CONVERTOR SYSTEM

3.1 Different methods for achieving a DC/DC Boost Converter

To build this boost converter that meets the teams' specifications the team needs the power stage that will provide the higher V output from a lower input. This circuit will be the daughterboard of the design to set the desired frequency for this converter the teams needs to design a pulse width modulation (PWM) circuit up to 20MHz to drive the boost converter.

A third circuit is needed to compensate for any variation in the output is called the error amplifier or control loop & monitors the output for a constant V. These stages make up the design for a high frequency DC/DC boost Converter with a control loop. Figure shows a block diagram for the boost converter.

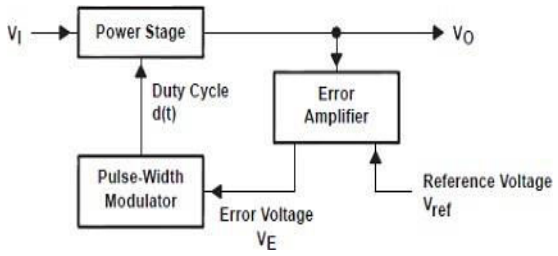

Fig-3.1 Building Blocks of a Boost Converter System

3.2 Step-down (Buck) Converter

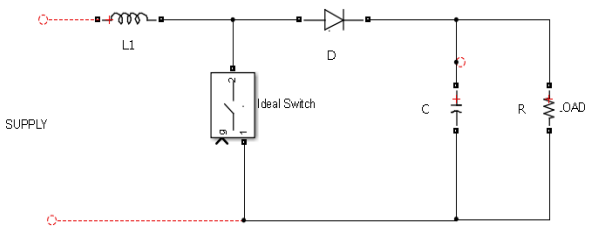

Fig- 3.2 Buck Converter

The step-down dc–dc converter commonly known as a buck converter is shown in figure, It consists of dc input voltage source VS controlled diode D, filter capacitor C, and switch S, filter inductor L, load resistance R Typical wave forms in the converter are displayed in under assumption which the inductor current is also positive, These state of the converter in that the inductor current is ever zero for any period of time is known the continuous conduction mode (CCM), & It can be seen from the circuit that when the switch Sis commanded to the on state the diode D is reverse biased.

When the switch S is off the diode conducts to support an interrupted current in the inductor, & The relationship among the input voltage output voltage and the switch duty ratio D can be derived for instance from the inductor

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voltage vL waveform, & the According to Faraday's law the inductor volt–second product over a period of steady-state operation is zero.

3.3 Step-up (Boost) Converter

Figure a depict a step-up or a PWM boost converter ,It is comprised of dc input voltage source V boost inductor L controlled switch S diode D filter capacitor C& load resistance R ,The converter wave forms in the CCM are presented in fig. When the transfer S is inside the on nation the contemporary within the increase inductor will boom linearly, the diode D is off at the time, When the switch S is off the energy stored in the inductor is released through the diode to the input RC circuit.

As demonstrated in Fig, the current supplied to the o/p RC circuit is discontinuous that a bigger filter capacitor is necessary in evaluation to that within the buck-derive dc converters

To limit the output voltage ripple. This capacitor filter must Provide the output dc current to the load when the diode D

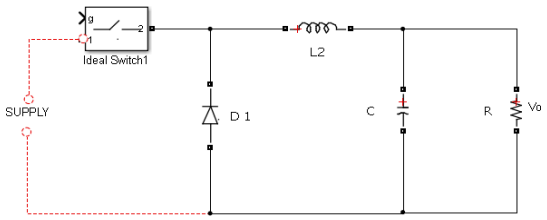

Fig -3.3 Step-up Converter

IV. PRINCIPAL OF OPERATION OF BOOST RECTIFIER

With the increasing of the world energy shortage & environmental pollution problems protecting the energy & the environment becomes the major issues for human beings. Some of the development & application of clean renewable energy such as solar, wind, fuel cell, tides & geothermal heat etc. are getting more & more attention. When solar power will be dominant because of following Factors:-

1. Efficiency increased of solar cells.
2. Improvement of manufacturing technology.
3. Economies of scale as predicted by the solar will provide the electricity up to 64% of the total energy by the end of this century.

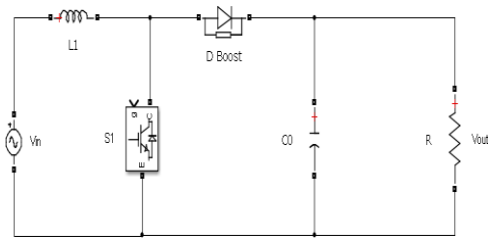

Fig – 4.1 Principal diagram

When the input voltage is less then desired output voltage Sboost operates to step up input voltage same as conventional Boost converter.

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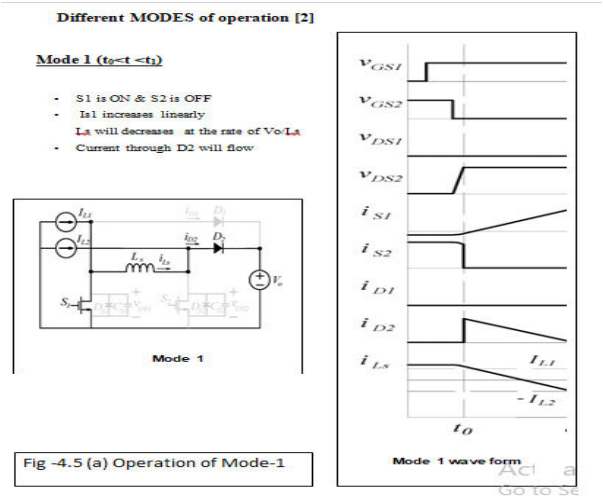

Fig -4.5 (a) Operation of Mode-1

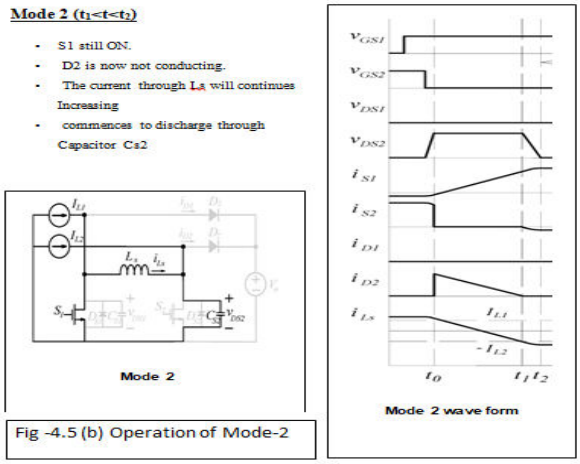

Fig -4.5 (b) Operation of Mode-2

4.2 Working Analysis

A boost converter of two phase interleaved is usually employed in excessive I/p modern and excessive I/p to- o/p voltage conversion applications. The circuit fig. of the t boost converter of two phases interleaved with uncoupled, Straight coupled, inversely coupled IBC are demonstrate in figure .

The two phases converter are driven 180 degrees out of phase, that is for the motive that the section shift to be provided depends on the wide variety of levels given by 360/n where n opinions for the No. of phases

$$\frac{di_{L2}}{dt} = -\frac{V_0}{L_1 + L_2}$$

V. SIMULATION AND RESULTS

5.1 Operation of Interleaved Boost Converter:

There are modes of operation such as renewable energy applications which includes photovoltaic module fuel cell in two phase interleaved boost converter. They are,

Mode 1operation

Mode 2 operation

Parameters	Values
Shunt Resistance (R_{sh})	10kohm
Series Resistance (Rs)	.001ohm
Output Voltage of PV cell	18.77 Volt
Inductor L1 & L2	300microH
Shunt Inductor (Ls)	270micrH
Output Capacitor (Co)	330microF
Output Voltage (Vo)	40.9Volt
Output Current (Io)	4.09Amp
Output Power (Po)	83.6Watt
Carrier frequency	20KHz

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5.2 Mode 1 Operation: (0 ≤ t < t1)

At t =0, the gate pulse is given to the switch 'S1' of the first phase. Then the 'S1' switch is having become on, the current through utilizing the sign L1 rises linearly.

At the similar time, the switch 'S2' inside the 2nd section is grew to become off and the strength stored inside the inductor L2 is transferred to the load via the output diode D2. In this time c language, the diode D1 within the first section is in opposite bias situation.

At time t0, S1 is closed. The current inside the inductor L1 initial off evolved to upward thrust even as L2 maintains to discharge. The rate of change of iL2 is about given through,

5.3 Mode 2 Operation: (t1 ≤ t < t2)

At t = t1, the gate pulse is given to the switch 'S2' of the first phase. Then the 'S2' switch is become on, the current through the sign L2 rises linearly. At the similar time, the 'S1' switch is turned off in the initial phase and the energy stored is switch to the load through the o/p diode D1 in the inductor L1.In this time interval, the diode D2 in the second phase is in reverse bias circumstance. At time t1, S2 is closed. The current in the sign L2 initial to rise while L1 not discharge. The rate of change of iL1 is about given through,

5.4 Simulink Model

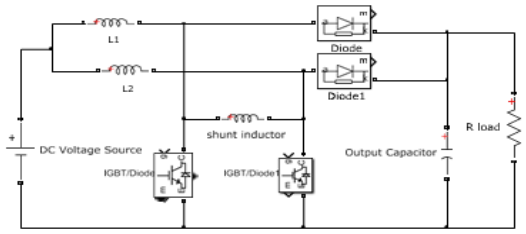

Fig-5.2 Simulink model of Boost Converter

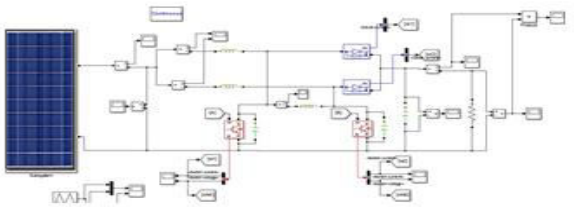

Fig- 5.3 Simulink model of Boost Converter with PV cell

5.5 PWM Technique

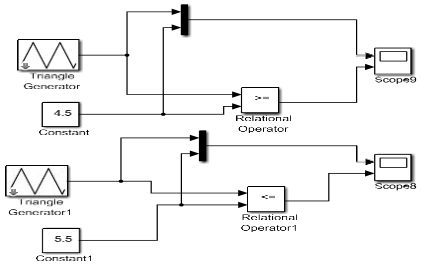

Fig- 5.4 Switching of MOSFETs with PWM technique

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5.6 Project model

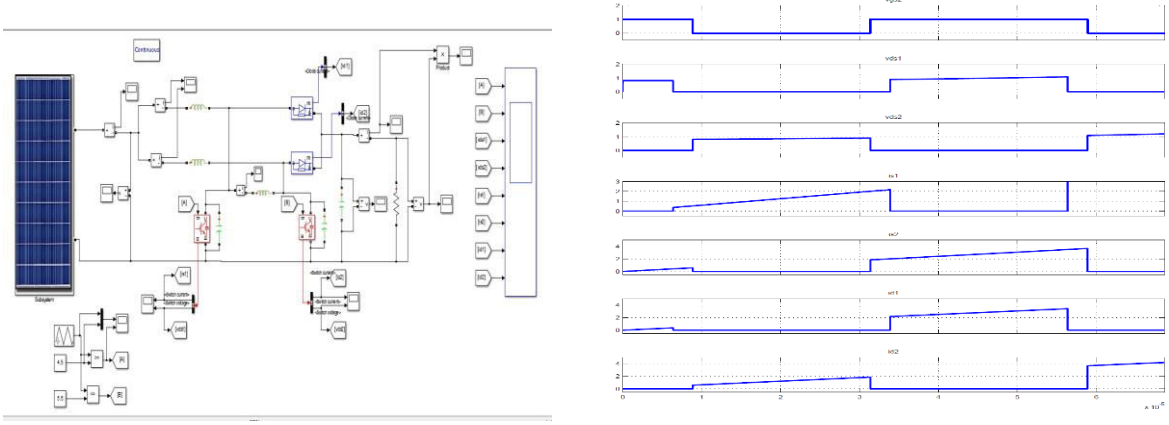
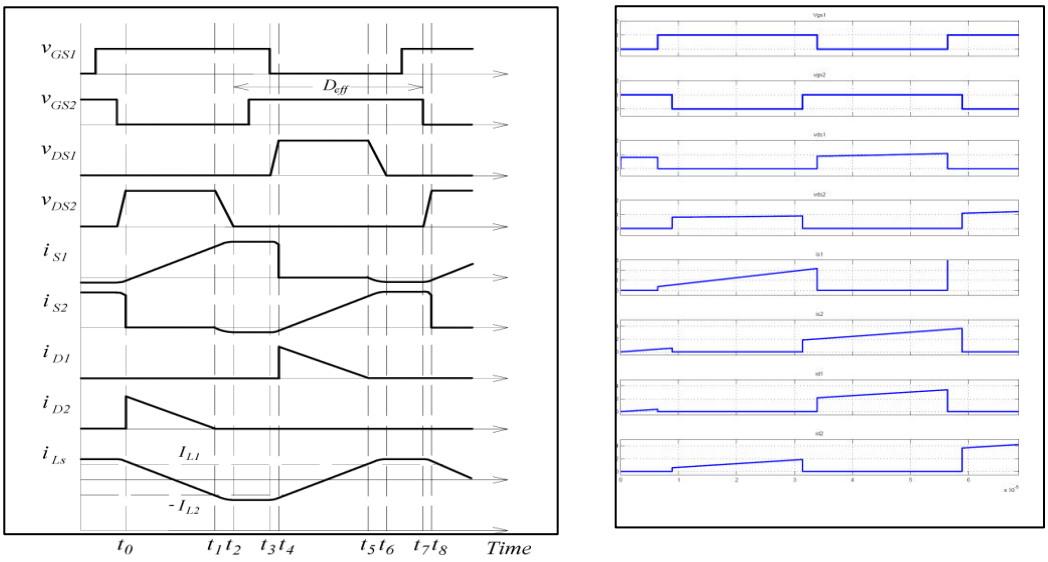


Fig- 5.6 Model representation of project

5.6 Comparison amid Simulation and theoretical result



VI. CONCLUSION

In this dissertation work simulative study of boost converter for photovoltaic cell now been carried out the output of PC cell was 18 V which has been boost to 40.9 V. During study it found that output transient response is good n and low ripple in input current. Converter risk controlled by varying the frequency switching of carrier waves. The results also shows that auxiliary inductor in the converter circuit is suppressing switching losses of power switches, without increasing current and voltage stress. It can be utilized as SMPS, Telecom Applications, and Satellite etc.

FUTURE SCOPE

Protection circuits are integral part of the converter system to protect the load from application of high voltage in case of failure in converter, to suppress the switch current ZCS technique should be used. Implement with this model by Hardware designing & ripple factor can be reduced more efficiently. In Over-voltage over-current protection could be added to existing block diagram. Soft-initial is necessary to avoid inrush of current at initial up & could be appropriately modeled an easy way to implement soft-start is by using a zero voltage switching or zero current switching.

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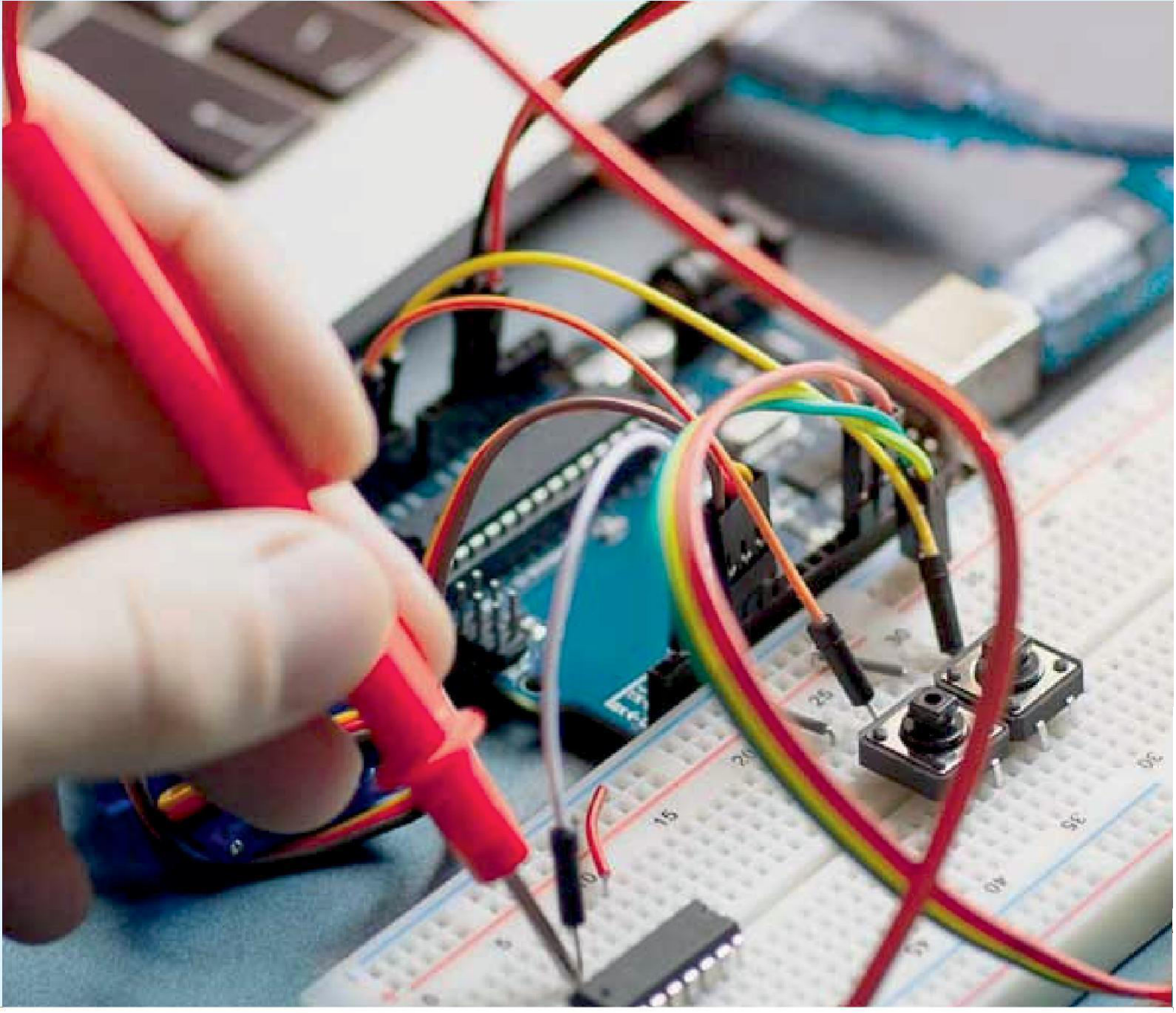

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