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MULTIPLE OUTPUT DC-DC CONVERTER FOR EV CHARGING STATION

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Abstract: It is necessary to use a dc-dc converter with multiple outputs if more than one load must be met simultaneously. The purpose of this study is to develop a multi-output dc-dc converter that is both extremely efficient and practical. The proposed converter may take a low voltage input, a medium voltage output, and a high voltage dc bus. DC-DC converter with multiple outputs circuits with a single power switch and a connected inductor are analysed and compared in Matlab Simulink. This suggested converter boasts remarkable efficiency throughout a broad output range.
Index Terms: Voltage clamping, soft switching, coupled inductor, mosfet switch, and boost converter.

I. INTRODUCTION

The use of renewable energy sources is becoming important in modern civilization. Over the past few years technological advances are made within the wind generation systems, photovoltaics, fuel cells, and hydroelectric power systems, just to call a couple of. With these advances comes the subject of the way to communicate these for standalone power generation, whether it's one or all of those sources simultaneously. alongside interfacing multiple inputs, a growing need for interfacing multiple outputs has become a stimulating topic in hybrid vehicles. Utilising DC-DC converters is one way to connect a system with several inputs and outputs. In certain cases, a dc chopper is a dc-to-dc voltage converter. It's a static -switching power supply that can take a constant direct current (DC) input and produce a variable (DC) output, all in a single conversion that uses an inductive intermediary to store energy. The output voltage may be a 'chopped up' quasirectangular version of the input dc voltage, thus the term "chopper." When the alternating current (ac) supply current is reversed, the thyristor devices are automatically shut off. this type of thyristor natural commutation is termed line or source commutation. It is obvious that source-facilitated commutation cannot occur in a thyristor circuit when a dc source is used. If the load is a resistive or inductive load, the current through the load will drop to zero, and the thyristor connected in series with the dc supply will shut off. Load commutation describes this kind of automatic shutoff that occurs in nature. Load current must be commutated using a self-commutating switch, such as a GTO thyristor, CGT, IGBT, or MOSFET, if the accessibility is dc and the heap current has no regular zero current periods, comparably likewise with the RL load. Since the SCR stays on after being latched on in this dc supply application, it is inappropriate. A buck converter is a kind of converter that may reduce voltage and boost current. The buck converter operates fundamentally by regulating the current in an inductor using two switches (often a transistor and a diode). within the idealized converter, all the components are considered to be perfect. The inductor has zero series resistance, the switch has zero drop while it is on, and no current flows through the diode when

it is off. The input and output voltages are also expected to remain constant during the cycle. If the output voltage of a DC-to-DC power converter is higher than the input voltage, we may call it a lift converter. It's a subset of SMPSs that requires at least one capacitor, one inductor, or both to store energy. This means that it requires something like two semiconductors (a diode and a semiconductor). The boost converter may be powered by a variety of different direct current (DC) sources, like batteries, sunlight based chargers, rectifiers, or DC generators. Usually alluded to as a move forward converter, a lift converter "moves forward" the voltage from its feedback. The ongoing streaming from the device is lower than that which powers it. [1] Multiple-output converters find widespread use in a variety of practical economic contexts. As a result, the facility supply designer is presented with an intriguing task in the form of the design of multi-output converters. Multi-output converters are a special kind of power supply that use a single main power stage to generate many independent output voltages. Miniaturisation and great efficiency are necessary conditions. Achieving a compact form factor necessitates a high switching frequency. The switching loss grows in proportion to the switching frequency. The facility's supplies will be used less effectively as a result of this. Some sort of delicate exchanging techniques must be utilized to work under high changing recurrence to solve this issue. The Zero Current Switched (ZCS) approach and the Zero Voltage Switched (ZVS) method are two examples of popular soft switching techniques. The switching loss may be greatly reduced and the dependability of the facility's power supply improved by using these methods, which include reducing the voltage or current to zero during the exchanging change. A bipolar supply, or even a step-up from a battery supply of comparable voltage, may be necessary for certain applications. The use of bipolar power supply in organic light-emitting diodes is also rather widespread. Thus, lift to move forward, buck-lift to accomplish negative stockpile, and straight controllers are often included in the design of an impact management IC to accommodate a wide range of power requirements. Low-turn-on-resistance metal-oxide-semiconductor (MOSFET) switches are employed to reduce conduction loss, Additionally, both low- and high-power dc-dc converters are frequently utilized [2-4]. Despite the fact that the facility is powered by unconventional energy sources like wind power, fuel cells, and so on, the recurrence part age framework is a compelling answer for the environmental pollution issue. is highly susceptible to changes in the climate, has a slow response time, and its output voltage is affected by changes in load. The system's complexity and cost increase when multiple SISO dc converters with differing voltage gains are integrated [5]. This study's primary objective is to make a multi-output converter that only requires one input, has a high intensify ratio, and reduces production costs.

II. MULTI OUTPUT DC-DC CONVERTER

A. Block Diagram

A dc-dc converter with a single input and many outputs is seen in Fig. 1.

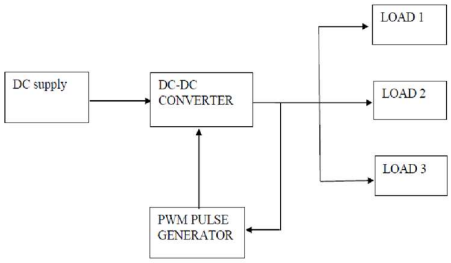

Fig1.Block diagram

DC supply: The input voltage of a circuit is often given as this. The 12V input voltage is used.
DC-to-DC converter: is a device that uses electronics to alter the voltage output of a direct current (DC) power supply. A quiet electric power converter, in other words. Mobile electronic gadgets, such as mobile phones and laptops, often get their power from batteries, hence DC to DC converters are utilized to change the voltage from the batteries into a usable direct current.

PWM: might also be used to describe a binary or discrete digital signal generated by a modulation method that encodes information into a periodic waveform.

Working

Here, the source's dc voltage is supplied into a dc-dc converter, which may increase the input voltage and then link that higher voltage to a variety of loads. The output voltages of this converter vary. These are the terminals with high, medium, and low voltages, respectively. The converter is managed by a pulse width modulation controller.

B. Circuit Diagram

. The proposed high-effectiveness SIMO converter architecture's system design for producing two voltage levels from a singular data power source is depicted in Fig. 2.

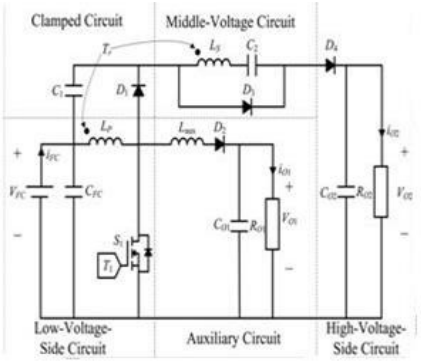

Fig 2. Circuit Diagram

The multi output converter incorporates a number of different circuits, including a clamper, a low voltage circuit, a circuit with a high voltage, a circuit with a medium voltage, a helper circuit, and a circuit with a high voltage. The direction of currents and the polarity of voltages are specified by the analogous circuit (Fig.2). To create the coupled inductor, Fig.3 shows an ideal transformer with magnetising and leaking inductors.

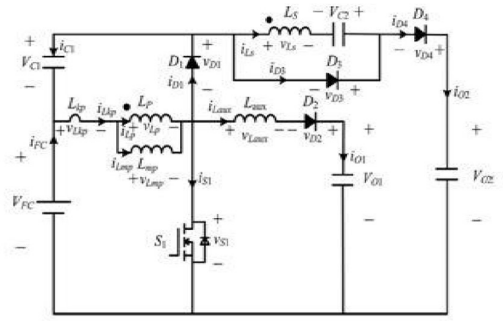

Fig3.Equivallent Circuit

III. MATLAB SIMULATION

The circuit requires an input power supply of 279.7VA. Powering several DC-DC outputs, this converter circuit produces 274.6 VA of output power. Thus, MATLAB Simulink is used to model the circuit's performance. PWM waveform 98.17 percent accurate. And last, we have the waveforms of the outputs. Additionally, the ratio of input to output power is used to determine efficiency.

A. Multiple DC-DC Converting Outputs

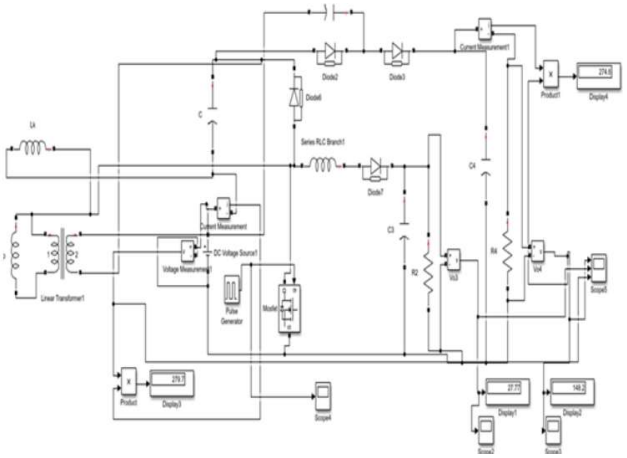

Figure 4: DC-DC Converter With A Single Input And A Double Output Construction of a Model in Simulink

The 12V input is what is provided. Both 27.77V and 148.2V are available as outputs. Figures 5 and 6 depict the PWM waveform and the input output waveform, respectively.

B. Triple Output DC-DC Converter

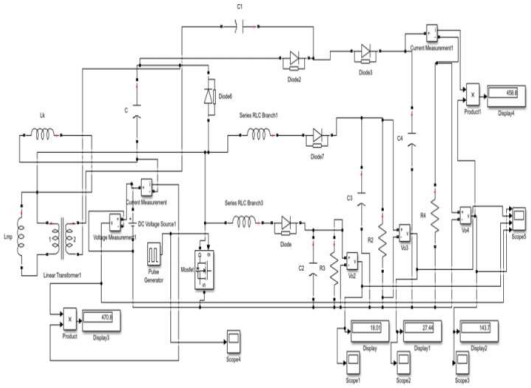

Figure 7: A Simulink Model of a Three-Output DC-DC Converter

The 12V input is what is provided. There are three different output voltages available, at 18,01V, 27.44V, and 143.7V, respectively.Figures 8 and 9 depict the related waveforms.

C. Four Output DC-DC Converter

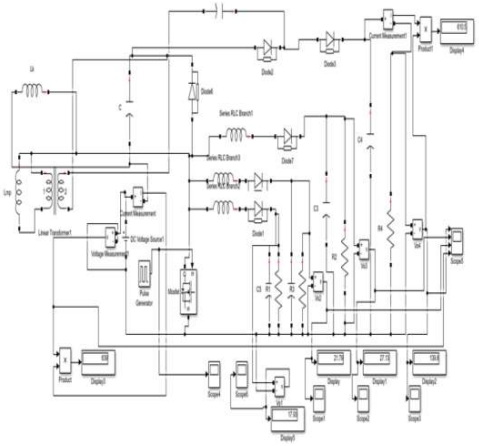

Fig.10.A DC-DC Converter With Four Outputs

There is a 12v input voltage available. The range of available output voltages is from 17.93V up to 139.8V. Figures 11 and 12 depict the PWM wave shape and the output voltage, respectively.

D. Five Output DC-DC Converter

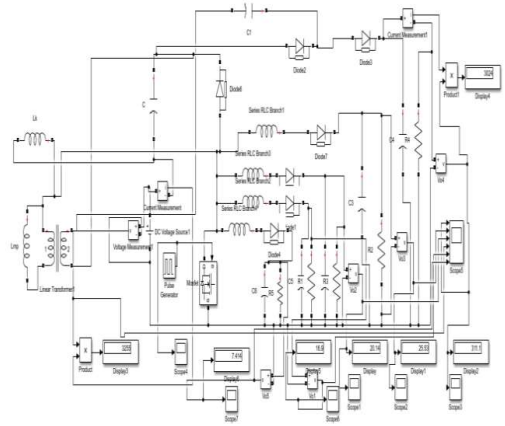

Fig. 13. Five outputs on a DC-DC converter

There is a 12v input voltage available. 7.417V, 16.82V, 20.01V, 25.53V, and 311.1V are the available levels of output power.

IV.RESULTS

Results of Double Output DC-DC Converter

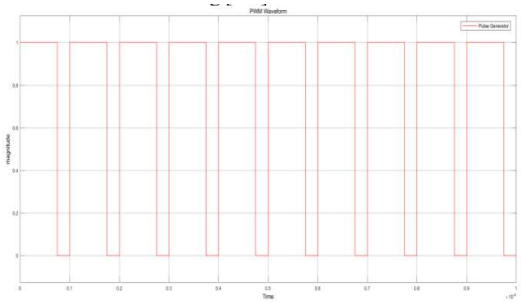

Fig5.PWM Waveform

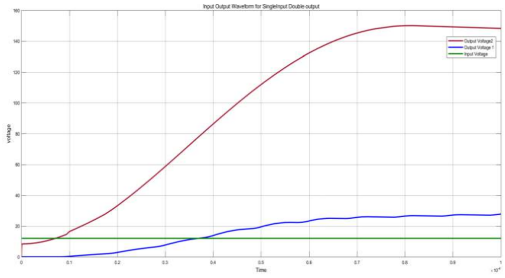

Fig.6: Waveform of Input and Output

Result of Triple Output DC-DC Converter

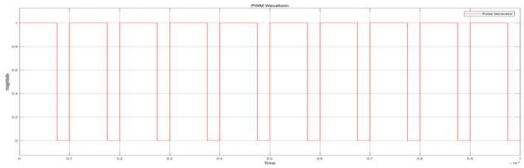

Figure 8: PWM Waveform for a Three-Way Output

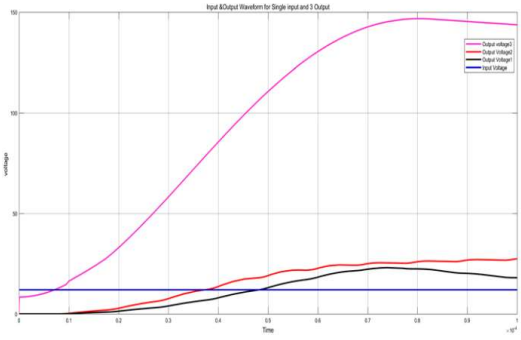

Figure 9: Graph with Three Outputs

Result of Four Output DC-DC converter

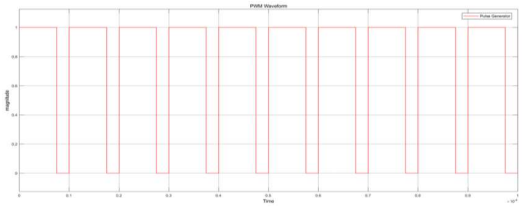

Fig11.PWM for Four Output

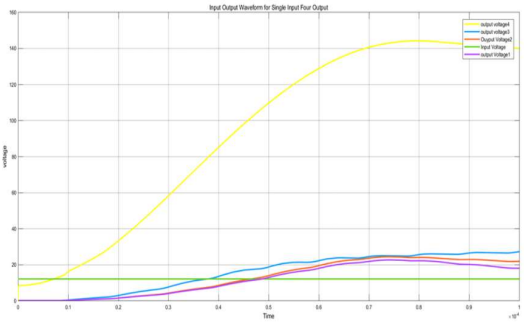

Fig.12.Waveform of Input and Output

The Output of a Five-Channel DC-DC Converter

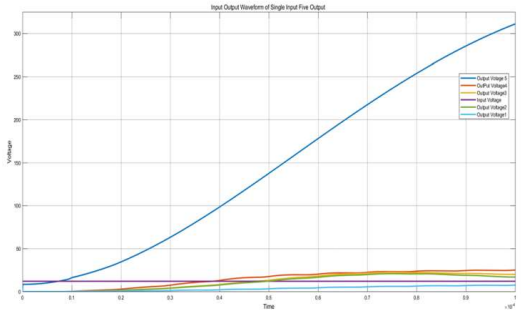

Fig 14.Output Voltage waveform

Table2 summarises the results from all Simulink models.

Table 2.Efficiency and Output Voltage

S.No	Configuration	Input(V)	Output(V)	Efficiency (%)
1	Double Output	12	27.77	98.17
			148.2	
2	Triple Output	12	18.01	97.45
			27.44	
			143.7	
3	Four Output	12	17.93	95.15
			21.79	
			27.13	
			139.8	
4	Five Output	12	7.417	92.9
			16.82	
			20.01	
			25.53	
			311.1	

V.CONCLUSION

A highly effective dc-dc converter with multiple outputs and a single input was developed in this research. Two input power sources, three output terminals, four output terminals, and five output terminals consisting of an auxiliary module, the middle voltages, and a high voltage dc bus were successfully converted by this coupled inductor-based converter. In light of the simulation, results, it seems that a single input terminal is used to power many outlets. To accomplish the goal of numerous outputs through power conversion, this design uses a single power switch.

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