PI BASED INTERLEAVED SEPIC CONVERTER FOR PV APPLICATIONS

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Abstract—Consumption of energy is gradually increased due to rapid development of Industrialization. whole world including our country is faced with an issue of back up power , exhaustion of fossil energy and global warming Solar radiant energy accounts for the most of the usable renewable energy on earth. Photovoltaic is the method of generating electric power by converting solar radiations into direct current electricity. The interleaved SEPIC converter is proposed for high precision in current transition, keep the voltage for various load applications and transfer energy for all irradiation levels. Interleaved SEPIC Converter is used to increase the voltage level when compared with ordinary SEPIC Converter. The output DC voltage is controlled by varying the duty ratio by PWM technique. To control the dc link voltage ,PID controllers were used. The proposed model provides reduced cost, lower switching losses, lower conduction losses and high efficiency.

Index Terms— ***Interleaved Converter (SEPIC), Photovoltaic***

I. INTRODUCTION

Fossil fuels have been the dominant source of fuel for electricity generation all over the world. As energy consumption is gradually increased due to rapid development of industrialization, the whole world including our country is faced with an issue of lack of backup power. The insufficiency of fossil fuel and increased need for energy has pushed us towards finding alternative sources of energy. There are many different sources of energy such as wind, solar ocean, tidal, thermal, geo-thermal, biomass, nuclear energy etc. Photovoltaic energy is a interesting source of energy; it is renewable, inexhaustible and non-polluting ,and it is more and more extensively used as energy sources in various applications. Therefore, solar energy is the important solution for increasing energy crisis. Solar energy which is one of the nonrenewable energy resources can be used for power generation . Maximum design is a joining of interleaved SEPIC converters to get ripple free output.[1] The main objective of Interleaved Modified SEPIC Converter is to implement maximum power point tracking . PWM method is use to control the duty cycles of DC/DC Converters to achieve the maximum power to satisfy the load demand. . The proposed extraction of power from the solar panel under varying conditions using fuzzy (Incr.) conductance and Perturb and observe method[2]. This converter has reduced the voltage ripple at the output, high voltage step up, low switching loss, faster transient response and reliability.

II. NEED FOR PROPOSED CONVERTER

The increasing costs of coal, oil, petroleum, nuclear and extension of power grid, and to reduce global warming, leads to enhancement in the development of the power system using Renewable energy sources. By combining solar panel with interleaved SEPIC Converter, output ripples can be minimized.

III.PROPOSED BLOCK DIAGRAM

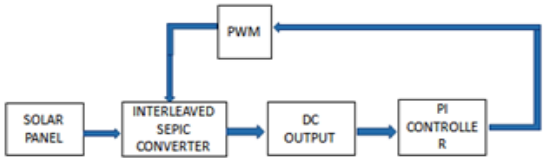


Fig 1.Block diagram

III.PHOTOVOLTAIC SYSTEM

The photovoltaic system employ solar panel which converts solar power into electrical power.[3] The solar panel contain with suitable number of solar modules on behalf of voltage and current requirement it was connected in series or parallel. The formula used here is to determine the generation of energy is given by

$$E=A*r*H$$

A-Area of solar panel(m^2),
r=solar panel yield annual average solar radiation on Skewed panel,
PR-Performance ratio
E-Energy (kWH)

E = Energy (kWh) A = Total

IV.INTERLEAVED SEPIC CONVERTER

DC Converter, Single-ended primary-inductor device is greater than, or smaller than, or equal to its input type Converter. The main advantage of interleaving is the reduction of ripples in input current and output waveforms.

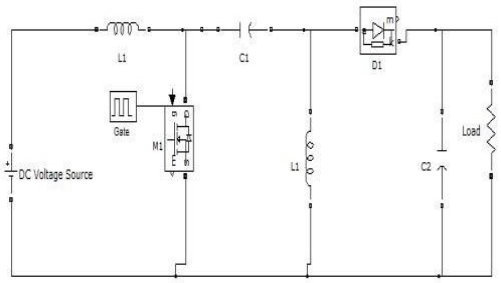


Fig 2 Circuit diagram of SEPIC converter

V.DESIGN OF INTERLEAVED SEPIC CONVERTER

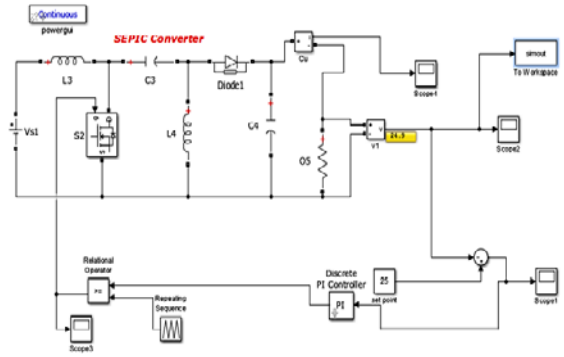


Fig3:Interleaved SEPIC converter with controller

Interleaving of DC-DC converters also known as multiphase operation . Ordinary DC-DC converters are switching at the same frequency which are operated in parallel manner causes a uniform phase shift between them which causes ripple at the input .

VI.DESIGN FEATURES

The interleaved SEPIC Converter can be designed by using this formulae.

Output voltage VO = D Vin/(1-D)
Boost inductor L1, L2 = D Vin/[fs (ΔILi)]
Intermediate capacitor C1, C2 = DVdc/ [(Rfs) (ΔVCi)]
Output filter inductor L3, L4 = (1-D)Vdc/[fs(ΔILo)]
Output filter capacitor Co = Iav /(2ωΔVdc

Where
D-duty cycle
Vin-Input Voltage
Fs-Switching Frequency

Inductor	L1=L2=L3=L4=220µH
Capacitor	C1=C2=220µF Cin=820µF Cout=470µF
Switching frequency	F=10kHz
Kp,KI	0.001,1

VI.PROPOSED CIRCUIT DIAGRAM

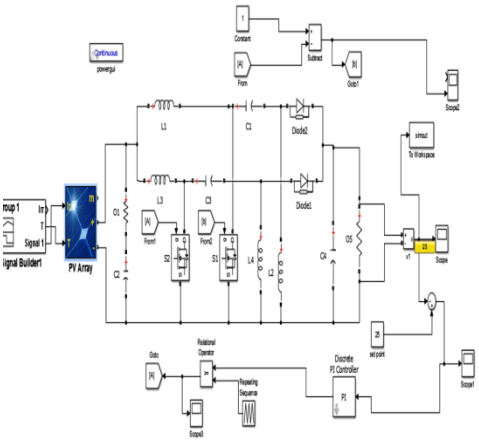
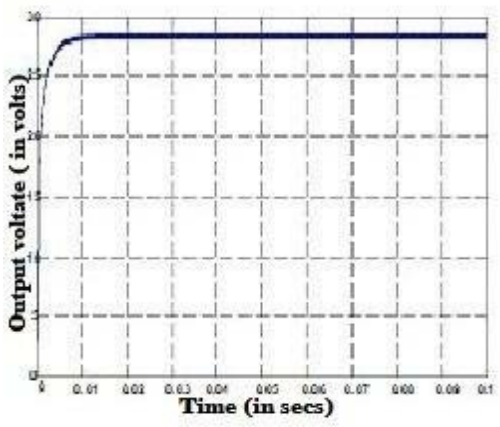


Fig4:Proposed Circuit Diagram.

The proposed diagram can be constructed using Matlab. The source taken here is Solar panel. From the panel the maximum power point tracking technology is applied to track the maximum intensity of solar energy. It is then fed in to the SEPIC Converter which will reduce the ripple content in the output part. The entire circuit is controlled by PI controller for tuning purpose.

VII.SIMULATION RESULTS



OUTPUT RIPPLE CALCULATION FOR SEPIC CONVERTER

$$\text{Output ripple (\%)} = \frac{\text{peak to peak ripple voltage}}{\text{dc output voltage}} * 100$$

$$= (0.41/25) * 100 = 1.64$$

OUTPUT RIPPLE CALCULATION FOR INTERLEAVED SEPIC CONVERTER

$$\text{Output ripple (\%)} = \frac{\text{peak to peak ripple voltage}}{\text{dc output voltage}} * 100$$

$$= (0.38/25) * 100 = 1.52$$

IX.CONCLUSION

Renewable energy sources are the non conventional energy type which can be continuously replenished by natural process. The solar panel voltage generation is one among the better solution for clean energy production. By using Interleaved Sepic Converter ,ripples present in the output side gets minimized. This converter design overcome the problems of Ordinary SEPIC converter. In future , this can be extended for hybrid systems.

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