Intelligent Maximum Power Point Tracking for PV Powered Converter

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Abstract. The world demand of power drives us to find innovative ideas to invent new energies or use the available energy efficiently. In this regards the Photovoltaic energy is been conclude as the clean and useful source of energy by the researchers. MPPTtracking technique is best for driving the PV panel to work always in maximum power invariable with changing climatic conditions.This paper deals with a solar powered SEPIC converter for MPPT of the source. The FLC is used for tracking Maximum value power for the system by keeping the voltage unchanged. This proposed MPPT system for SEPIC converter maintains high efficiency in changing climatic conditions and in also in partial shading conditions. The results shows that the solar powered DC to DC SEPIC converter with MPPT power monitoring controller enhance to its high efficiency of the solar power generation system.

Key words: SEPIC, FLC control, MPPT controller, MPPT

1. Introduction

Among, Renewable energies available solar energy being advantageous in terms of various concerns.As we know the solar energy is amply available, environmental friendly, maintenance free and wide range of applications. Though it has various advantages we need to concentrate on few areas which to be improved in order to improve the efficiency of the solar power generation systems.[1]

The energy from the sun cannot be absorbed and utilized properly because of changing climatic conditions and partial shading constraints. An MPPT controller is crucial for the system with the aim to track the maximum value of power at every instant in order to make the solar power generation system works efficiently. The MPPT controller is installed between the source and the load. It also solves the problem of load imbalance in the case of source- load imbalance.[2]

The author has designed an MPPT photovoltaic Charge Controller, by using the PWM signal the semiconductor switches of the buck step down converter the voltage is adjusted in order to track the maximum power at every instant.[3][4]

The author has also has proposed an MPPT PV charge controller here,thegate drives of the semiconductor switches in the buckconverter are maintained in its value by the micro-controller unit. The microcontroller unit is loaded with the Perturb-observe (P and O) algorithm in aim to predict the possible maximum value of power point at every instant.In a solar power plant an intelligent powermanagement based FLC controller is proposed.[5]. Where, the variations in the speed of the induction motor is controlled by the FLC controller. PV charging control of the power control circuit at less costand reliable is achieved. A solar based SEPIC converter, to have less power losses in higher switching frequencies, amaximize low ripple, highefficiency for street lighting application[6]. SolarSEPIC Converter,DC to DC in aim to realize the concert of the Photovoltaic power fed DC to DC SEPIC converter. [7][8].

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2. System Description of ILBC

The schematic plan diagram of literature survey systems is shown in Fig 1.shows the existing system of Photovoltaic powered SEPIC converter the output of the system is a DC load. In Fig: 2 shows the proposed photovoltaic powered DC to DC SPEIC converter is shown where the output is connected to a DC load.

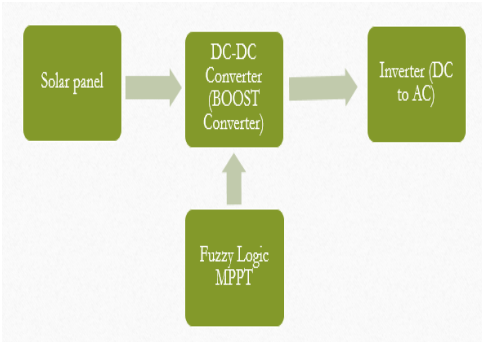


Figure 1 Schematic of Literature system

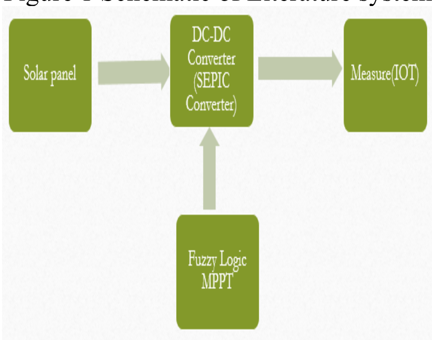


Figure 2Schematic of Designed System

In the Literature survey system a DC toDC converter for boosting the voltage is connected. Since the system is solar powered the value of voltage received from the Photovoltaic panel is boosted. But in the literature surveyed systems the ripple in the output waveform voltage is high, since the maximum current flows through the power transistor the damage of the switches are more. Power regulatory problem is witnessed and also bulky in nature due to large sized semiconductor components

3. Simulation Results

The Fig: 3 shows the schematic diagram of the solar powered DC to DCconverter SEPICis fed to a Direct Current load. Since the voltage received from the PV is not constant due to partial shading and varying climatic conditions. A MPPT controller is implemented in the system which tracks the power maximum at every instant. The MPPT controller is implemented using on FLC technique. The Table: 1 display the simulation parameters of the DC to DC SEPIC converter system.The Table: 2 display the Simulation circuit parameters of the solar panel. The Fig: 4 display the Simulation circuit diagram the solar panel.Table: 3 display the Simulation results of the photovoltaic powered SEPIC converter. The input voltage of 31.55 volts is boosted to voltage of 226.9 volts and power of 51.49 Watts is developed with reduced ripples in the waveform. With simulationresults it is evident that the ripples in the output waveform are reduced in the proposed system than the existing system.

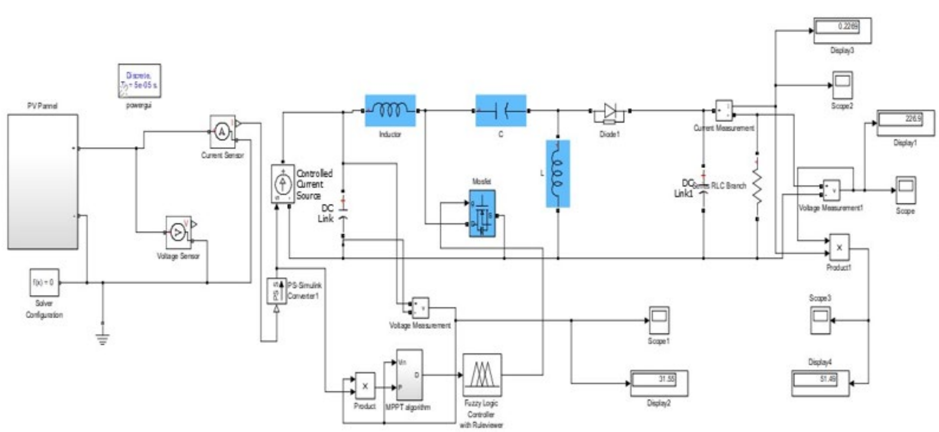


Fig 3Simulation of circuit diagram of solar powered DC DC SEPIC converter system

Table 1 Simulation Parameters of the DC DC SEPIC Converter

Components Rating	**Boost converter**	**SEPIC converter**
Solar Panel	35V	35V
Capacitor (DC Link)	50 e^{-6}	50 e^{-6}
Inductor	200 e^{-6}	200 e^{-6}
Diode	5V	5V
Resistive Load	20 ohms	20 ohms
MOSFET	600V/40 Amps	600V/40 Amps

Table 2: Simulation Parameter of the PV panel

Measurement	**Rating**
Isc:SC current,	7.34 A
Voc : OC voltage	0.6 V
Irradiance	1000 W/m^2
Quality factor	1.5
Series resistance, Rs:	0 Ohm

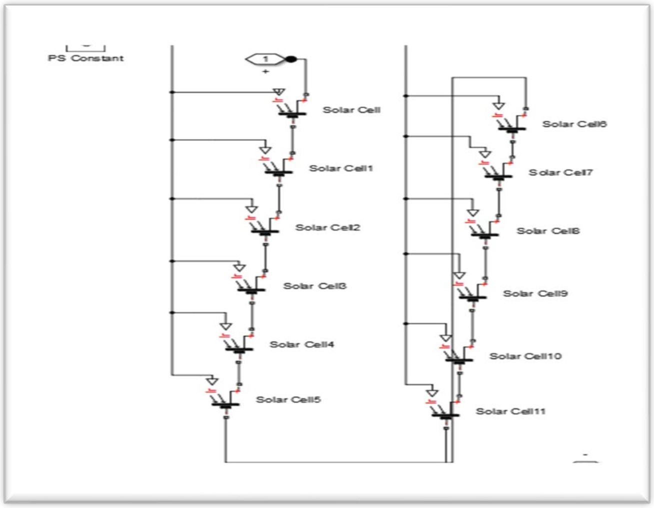
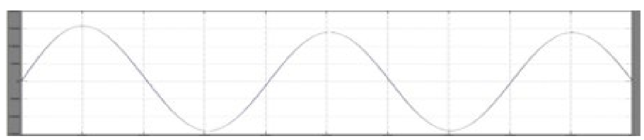
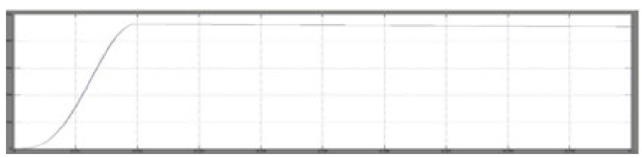
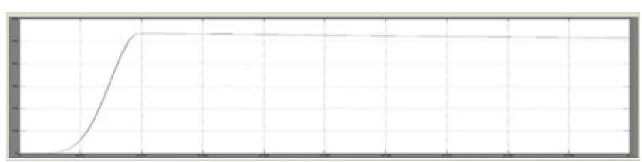


Fig:4 Simulation Circuit diagram of Solar Panel

Table 3 Simulation resultsof the Solar powered DC DC Sepic Conveter

Measurement	Value	Waveform
Input Voltage	31.55 V	
Output Voltage	226.9 V	
Power	51.49 W	

4. MPPT Controller Based on FLC Technique

Since the input of the system is a solar panel the voltage is variable due to partial shading and the changing climatic conditions. So aMPPT controller is essential in aim to track the power maximum highest value point. So in this work a FLCbased MPPT controller is integrated for tracking the power maximum at every instant. The Fig: 5 display the schematic plan diagram of FLC system integrated in the simulation circuit diagram. Table: 4 display the Rule table of the fuzzy system. Fig; 6 shows the surface view graph of the implemented fuzzy logic system.

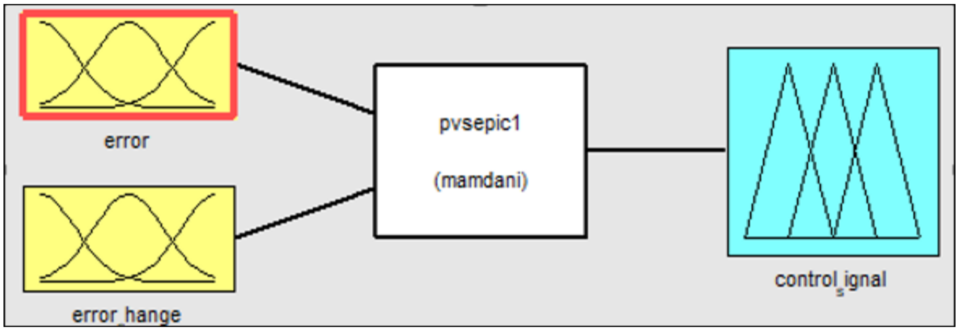


Fig: 5 Block Diagram Fuzzy logic Technique

Table: 4 Fuzzy Rule Table

E^f/E	N-II	N-I	Z	P-I	P-II
N-II	N4	N4	N4	N3	Z
N-I	N4	N2	N1	Z	P3
Z	N4	NI	Z	P1	P4
P-I	N3	Z	P1	P2	P4
P-II	Z	P3	P4	P4	P4

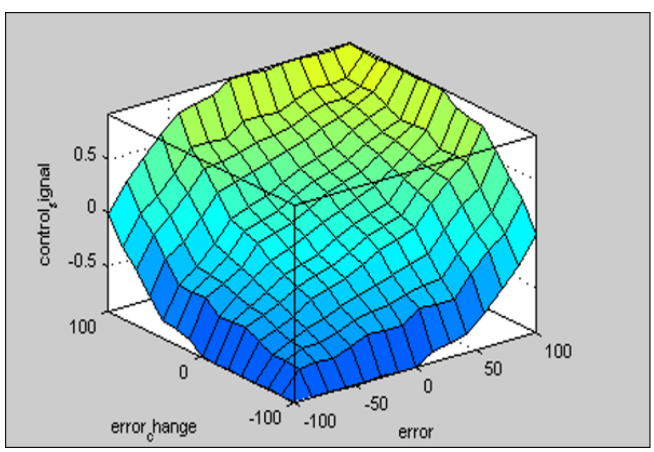


Fig: 6 Fuzzy surface view graph

5. Hardware Results

The Hardware snap shot of the solar powered DC to DC SEPIC converter is shown in the Fig 7 .It shows the hardware and the solar panel is kept in the sun for working.Table: 5 shows the hardware components present in the converter.Table 6 hardware done results of both the values and the snapshots In different shading conditions.

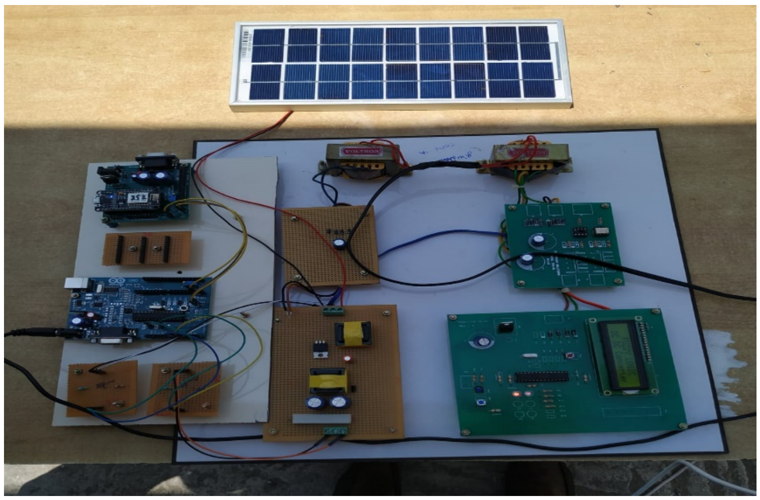


Fig 7 Hardware snap shot of solar powered DC DC SEPIC converter

Table: 5 Hardware Component (Ratings)

Components Rating	Boost converter	SEPIC converter
Solar Panel	12V	12V
Capacitor (DC Link)	47 e^{-6}/50V	47 e-6/50V
Inductor	50 e^{-3}	50 e^{-3}
Diode	8 Amps/500V	8 Amps/500V
Resistive Load	100 ohms	100 ohms
MOSFET	600V/40 Amps	600V/40 Amps

Table 6Experimental results of both the values and the snapshots

(In different shading conditions)

Measurement /% of Light	Input Voltage	Output Voltage	Pictorial Representation
0%	0 – 2V	31.55 V	
25%	3 – 2V	226.9 V	
50%	5 – 4V	51.49 W	
75%	7 – 8V		
!00%	9V		

6. Conclusion

The solar powered SEPIC converter with power maximum point tracking MPPT controller is simulated. The hardware of the solar powered DC to DC converter SEPIC is formulated and employed. The Fuzzy logic controller is designed and simulated for tracking the power maximum in the system by keeping the voltage unchanged. This proposed MPPT system for SEPIC converter maintains high efficiency in changing climatic conditions and in also in partial shading conditions. The results shows that the solar powered DC to DC SEPIC converter with MPPT controller.The shows improved efficiency of the solar power generation system which is confirmed with the simulation and the hardware results.

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