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Design of Interleaved System of Cuk Converter Applied in Controller of Proportional Resonance

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A B S T R A C T

The day today need of power generating system should be balanced in the real world aspects sum of the methodologies used to balance the sufficiency of generating system and there designs is discussed in brief. A designed model of cuk converters applied with the controller of proportional resonance is briefly discussed with the simulation. The modeled design is applied in a mini range scale and its software simulated results are tabulated.

Keywords: Interleaved Cuk Converter (ILCC); Maximum power point trackers (MPPT); Proportional \ Resonance Controller (PRC); Pulse Width Modulation (PWM); MatLab - Sim Power Systems

1. Introduction

A novel design with photovoltaic system to generate the power is applied by interleaved cuk converter with the implementation of proportional resonance controller in a parallel arrangement to get the maximum power generation as a green revolution. The existing models for the photovoltaic system are not sufficient to overcome the daily usage of power generation and there is a need of new methodologies in the field of photovoltaic system. By introducing a parallel arrangement of cuk converters is designed and implied with controller of proportional resonance in a closed loop system to get an efficiency results. The designed model is stimulated using sim power system and results were tabulated.

Generally photovoltaic system was explained as the energy transformation from the sun as heat energy to power system management as power energy used in the day today life. Mostly the generation of power is done by many methodologies which are not eco friendly, to overcome this difficulty resent research models turn towards photovoltaic system. In this research, focuses on the power generation for a small scale products using photovoltaic energy system. A new designed of Simulink diagram is proposed with the parallel Cuk converters operated for the closed loop system implied by proportional resonance controllers for the power generation.

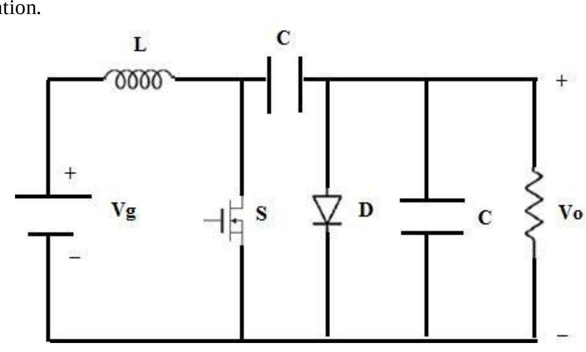

Fig.1 Circuit Diagram of Cuk Converter

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The optimality is reached in this new model for a small scale produces and the results given by the simulation is enough to attain the need. The general model of cuk converters is applied in the mechanism of input and output system in generation of power. The network switching is a controlled by the process input and output system in an alternate combination of the capacitors in order to rise the energy. Therefore the conversion ratio of cuk converter is as M (D) = - D/ (1-D). The working principle of cuk converter is shown in the Fig.1. as a circuit diagram and the graph of the conventional ratio is shown in Fig.2.

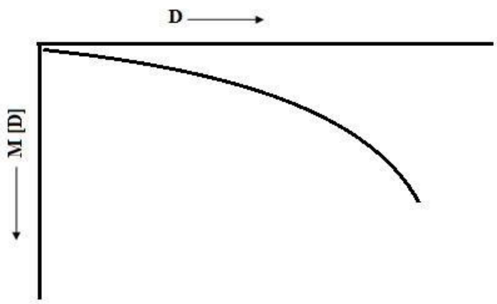

Fig.2 Graphical Representation of Cuk Converter

The application interleaved cuk converter in the closed loop model in power generation using Proportional Resonance was not applied in the literature. By applying closed loop system in Proportional Resonance as an interleaved cuk converter in solar system is done and executed with a simulated result. The Block Diagram of Proportional Resonance Controller with interleaved cuk converter for solar system is shown in Fig. 3.
An interleaved cuk converter gives an output with step up photovoltaic system of DC output. The DC output is converter to AC load by using H - bridge inverter. A comparison for the voltage reference of the output with the error of proportional resonance is made. The Fig.4 is shows the design of PR controller flow chart.

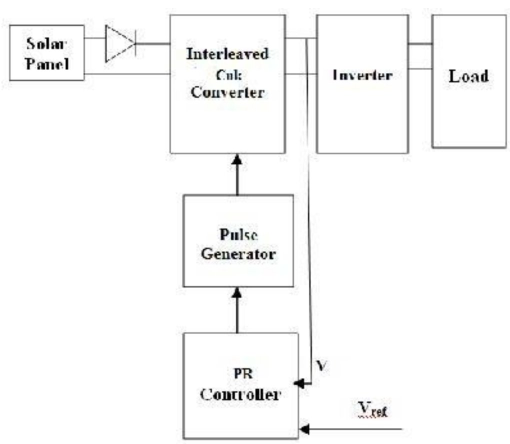

Fig.3 PR Controller in Photovoltaic ILCCI system

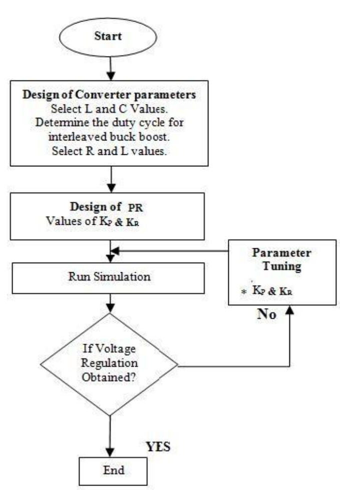

Fig. 4 Design of PR Controller Flow chart

2. Simulation Results

The result of closed loop proportional resonance controlled Interleaved Cuk Converter system is presented.

Proportional Resonance Controller for Closed Loop System

Fig. 5 shows the Proportional Resonance Controller in a closed loop system using Interleaved Cuk Converter. The voltage output produced by DC model in interleaved cuk converter design is compared with the reference voltage. The application of proportional resonance controller gives a small change in the error. The proportional resonance controller with interleaved cuk system updates the pulse width modulation. The Input voltage waveform of Photovoltaic System is represented in the Fig. 6.

The DC link voltage waveform of Converter Output is shown in Fig. 7. The Output voltage of inverter with PR controller is represented in the Fig.8. The Output current of Inverter with PR Controller is shown in Fig. 9. The Table I is the comparison of the output load resistance with the Current and Power. The parameters with respect to time domain of Proportional resonance Controller are shown in Table II. The simulation results with requirements of Interleaved Cuk Converter are represented in Table III. The Summary of K_p and K_R is shown in Table IV.

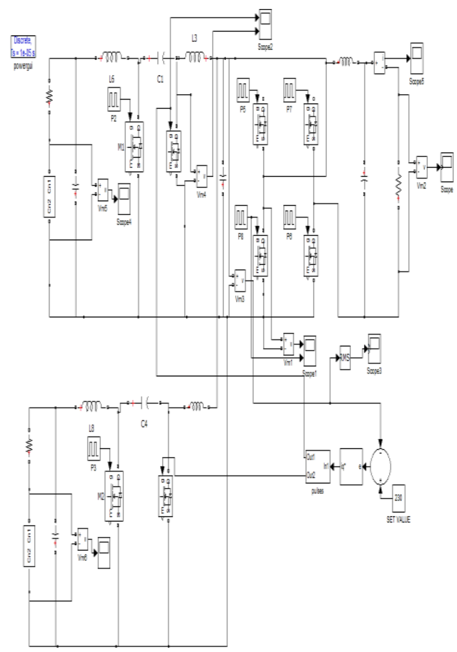

Fig. 5 PR controller in a closed loop system using Interleaved Cuk Converter

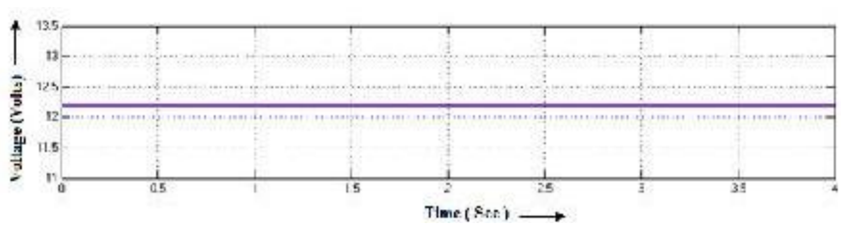

Fig. 6 Input voltage waveform of Photovoltaic System

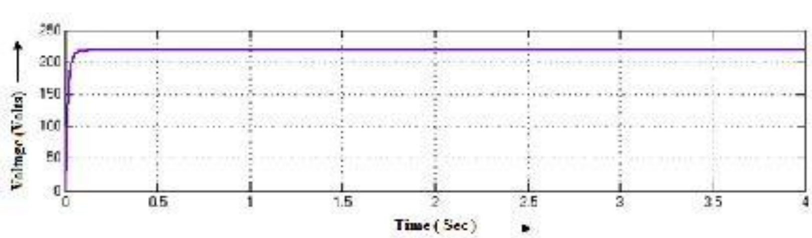

Fig. 7 DC link voltage waveform of Converter Output

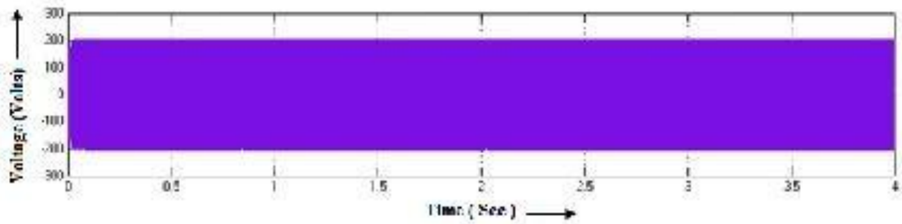

Fig. 8 Output voltage of inverter with PR controller

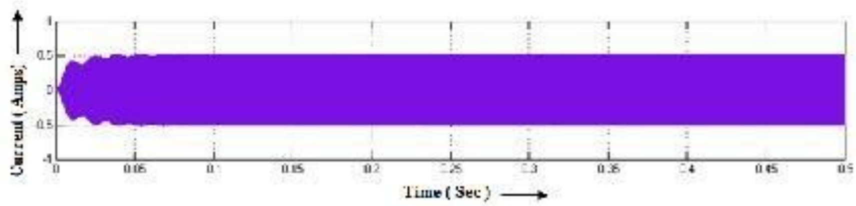

Fig. 9 Output current of Inverter with PR Controller

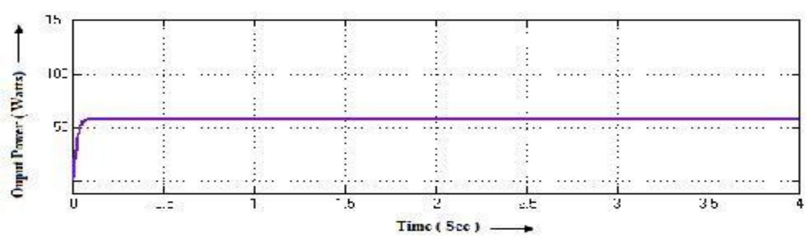

Fig. 10 Output Power of Inverter with PR Controller

Table I. Comparison of the Output Load Resistance – Current / Power

Sl.No	R_L (Ω)	Voltage (V)	Current (A)	Power (W)
1.	100	160	1.6	151
2.	200	187	0.94	98.8
3.	300	195	0.65	73
4.	400	202	0.5	58.2
5.	500	200	0.41	48.3
6.	600	200	0.35	41.3
7.	700	210	0.3	36
8.	800	213	0.26	32
9.	900	214	0.24	28.7
10.	1000	215	0.2	26.1

Table II. Time Domain Parameters Using Pr Controller

Type of Controller	Rise Time	Peak Time	Settling Time	Steady State Error
	Sec	*Sec*	*Sec*	*Volts*
PR	0.2	0.3	0.5	1.1

Table III Requirement and Simulation Results of Interleaved Buck Boost Converter

Sl.No	Description	Simulation
1.	Solar Power PV Output	9V
2.	IGBT	G4BC305
3.	Power Diode	IN4007
4.	Inductor	7 MH
5.	DC Capacitor	2000MF/250V
6.	Capacitor Filter	55µF
7.	Inductor Filter	0.8µH
8.	Output Voltage of Converter	240V
9.	Output Voltage of Inverter	238V
10	Inverter Frequency	50HZ

TABLE IV Summary of K_P AND K_R

Types of Controller	K_p	K_R
PR	0.15	1.2

3. Conclusion

The photovoltaic system of power generation is applied in controller of proportional resonance with Cuk converter interleaved arrangement. The designed model is a special arrangement of the converters in a parallel set implemented in the generating system. The entire system is controlled by applying the closed loop methodology in order to reduce error proportionality. The modeled design of close loop arrangement of parallel system in the cuk converter is simulated and results are tabulated.

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