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Cuk Converter for Photovoltaic Energy System: A Review

Prinkesh Soni[1], Rakesh Singh Lodhi[2], Amit Solanki[3], Ankush Yadav[4]

PG Scholar1, Associate Professor2, Associate Professor3, Assistant Professor4

Department of Electrical and Electronics Engineering, Oriental University, Indore (M.P.) India

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Abstract –*The reason behind the sudden rise in the demand of solar PV systems is that they generate electrical energy without polluting the environment. However the sun radiation never remains same it varies according to the position of sun. In this review analysis of a circuit which is designed such that it gives constant and stepped up dc voltage to the load. A Synchronous Cuk Converter is used for examine the performance of solar PV system. cuk converter is a chopper which reduces losses with MOSFET the conduction losses are reduced andswitching losses are reduced.*

***Key Words*:Cuk converter, Synchronous cuk converter, photovoltaic system, MOSFET, auxiliary and main circuit.**

1. INTRODUCTION

Renewable energy resources [1] and significant opportunities for energy efficiency exist over wide geographical areas, in contrast to other energy sources, which are concentrated in a limited number of countries. Rapid deployment of renewable energy and energy efficiency, and technological diversification of energy sources, would result in significant energy security and economic benefits.
Grid interconnection [2] of PV power generation system has theadvantage of more effective utilization of generated power.However, the technical requirements from both the utility powersystem grid side and the PV system side need to be satisfied toensure the safety of the PV installer and the reliability of the utilitygrid. Clarifying the technical requirements for grid interconnectionand solving the problems such as islanding detection, harmonicdistortion requirements and electromagnetic interference aretherefore very important issues for widespread application of PV systems. Grid interconnection of PV systems is accomplishedthrough the inverter, which convert dc power generated from PVmodules to ac power used for ordinary power supply to electricequipments. Inverter system is therefore very important for gridconnected PV systems.

For storage or other DC components to be used in conjunction with AC loads, some type of power conversion capability is required. Considering that the output characteristic of a photovoltaic cell has a wide voltage range, depending on the operating conditions of a photovoltaic cell, the DC/DC converter needs to have a wide input voltage range to regulate the constant output voltage. To achieve high step-up and high efficiency DC/DC converters is the major consideration in the renewable power applications due to the low voltage of PV arrays and fuel cells. The purpose of dc-dc converter is insure the impedance adaptation between the PV source generation and the main utility by tracking the reference voltage required by the grid. The DC-DC converter converts a DC input voltage, to a DC output voltage, with a magnitude lower or higher than the input voltage.[3]

There are several different types of dc-dc converters, buck, boost, buck-boost and cuk topologies, have been developed and reported in the literature to meet variety of application specific demands. There is a synchronous DC-DC cuk converter design and implement for photovoltaic application. Synchronous cuk converter has a significant advantage over other inverting topologies since they enable low voltage ripple on both the input and the output sides of the converter. So, the performance of photovoltaic system and the output efficiency of converter is improved.[4]

2. RECENT RESEARCH WORKS: A BRIEF REVIEW

There are different authors are worked on topic and the main key points of this topic are :

1. Renewable Energy
2. Solar Energy System (Photovoltaic System)
3. Synchronous Cuk Converter

As per analysis of researchers' some analysis shows in below table:

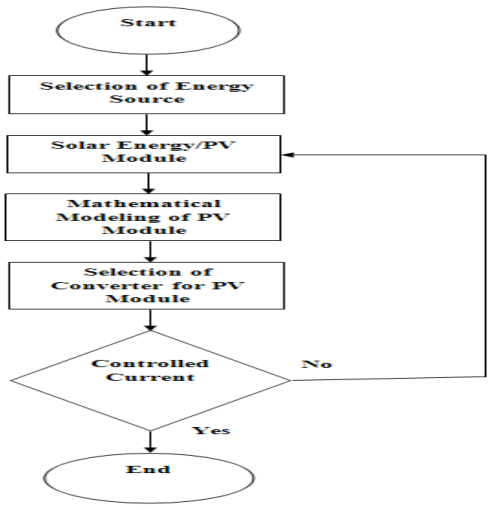
Table-1: Research Summery at a Glance

S. No.	Author	Converter	Techniques	Outcome
1	Shiba Arora, Pankaj Sharma	Buck Boost	maximum power point tracking (MPPT)	Results show that the overall model behaves like the real situation
2	Shridhar Sholapur, K. R. Mohan, T. R. Narsimhegowda	Buck Boost	maximum power point tracking (MPPT)	Solar array is operated at maximum power point irrespective of solar irradiance.
3	C.Jena, Amruta Das, C.K.Panigrahi, M.Basu	Buck Boost	One-diode equivalent circuit	Clear & concise understanding of the I-V and P-V characterizes of PV module
4	Rajeswari R.V, Geetha A	Buck-boost and Cuk	DC-DC converters	Te overshoot of these types of converters is Reduce
5	Aarti Gupta, Preeti Garg	Inverter Topologies	Two level inverters and multilevel inverter topology	The total harmonic distortion of V & I in grid tie three level inverter system in reduced to a large extent than the two level one
6	This Paper	Synchronous Cuk	Simulation	Solar Energy System

3. Photovoltaic Energy System

Cuk converter based photovoltaic energy system is used with the help of mathematical modeling in for analyzing voltage and current. Solar PV module is essential for generating DC voltage. Cuk converter is used for uplifting the voltage level as per requirement of load.

Photovoltaic energy system problem based algorithm are shown below figure.Selection of energy source like PV system and converter selection process with analysis of PV module.



6. CONCLUSIONS

The Cuk converter based solar PV system was considered for simulink through programming in MATLAB. It is based on the electrical equations of the solar PV module. A MATLAB/Simulink model was designed to validate and study the effects of temperature and irradiation. The solar PV module was used to analyze the Cuk converter based PV system. The input voltage (Output voltage of the solar PV module) of the Cuk converter-based solar `PV system was regulated for the change in irradiation using a voltage controller. Also the DC-DC Cuk converter used in solar PV system was stable and the input voltage was kept within the specified range under disturbances at the source voltage and the change in irradiation.

The inverter model, particularly when coupled with an accurate array performance model, provides significant improvements in the ability to analyze PV system performance, monitor inverter and array performance, and diagnose causes of system

Special situations such as sudden change of temperature and solar radiation have been simulated and analyzed.

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BIOGRAPHIES

PrinkeshSoni is a PG Scholar, department of electrical & electronics engineering at Oriental University, Indore (M.P.). He is working on new research of Solar Energy System.

Rakesh Singh Lodhi is Associate Professor, department of electrical & electronics engineering at Oriental University, Indore (M.P.). He is in academics and research from last eight years and has guided research projects on post graduate level. He is also working in new research areas such as Cuk converter, PV system.

Amit Solanki is Associate Professor, department of electrical & electronics engineering at Oriental University, Indore (M.P.). He is in academics and research from last nine years and has guided research projects on post graduate level.

AnkushYadav is Assistant Professor, department of electrical & electronics engineering at Oriental University, Indore (M.P.). He has done M.E. in Power Electronics from SGSITS, Indore. Currently he is working in new research areas in PV systems.