

A Grid Connected Luo Converter with MPPT Technique

¹D.Thamizhthendral, ²V.ashok kumar

¹PG Student(PED),Dept of EEE , Roever Engineering College,Perambalur
Tamilnadu,India

²Assistant Professor,Dept of EEE, Roever Engineering College,Perambalur
Tamilnadu,India

Abstract

This paper proposes a grid connected single stage converter system for PV applications using Luo converter. Single stage converter system is the system which does two stage operations in one stage. A Luo converter is an advanced dc-dc converter which uses voltage lift technique and the voltage is increased in geometric manner. In this paper, PV power to the distribution system by continuous maximum power tracking. Maximum power point is regulated by controlling the input voltage to the converter. Input voltage control helps for easy functioning of MPPT algorithm. The Luo converter is used along with coupled inductor for the purpose of high gain. The proposed system is simulated using MATLAB/SIMULINK

Keywords — component;Maximum power point tracking, luo converter, voltage lift technique

I. INTRODUCTION

Due to increase in power demand and far distance power transmission from source to the distribution side, an efficient power transmission is required. Fossil fuels and thermal power plants which may or may not be near to the load centers. Because of these problems,we are goes for renewable sources of power generation. PV becomes a better solution for these problems.Photovoltaics (PV) is a method of generating electrical power by converting sunlight into direct current electricity using semiconducting materials that exhibit the photovoltaic effect. A photovoltaic system employs solar panels composed of a number of solar cells to supply usable solar power The output voltage of the PV is depends on temperatures, insolation etc. Hence PV power transfers to grids, for the purpose a perfect converter and inverters is needed.Generally, the output voltage from the PV is either step-up or step-down and then convert it into ac by means of inverter. On power transfers it has two stages and hence defined as two stage conversion system (TSCS). The TSCS has drawbacks as more losses , high cost and large size. Because of these drawbacks , single stage conversion system (SSCS) is preferred. SSCS is the conversion system which does both the dc-dc and dc-ac conversion in single stage. The advantages of SSCS

is more reliable and less in cost[1]. DC/DC converters are widely used in solar power generation because of the production of minimum voltage on PV cell and hence these converters are used to boosts the output voltage of the PV [2].

Now-a-days DC/DC converters are preferred in many fields such as domestic, business, agricultural and the industrial fields because of its reliability, smaller size and high quality. The three main types in DC/DC converters are transformer less, isolated and resonant converters. The transformer less converters are of three types : they are buck, boost, buck-boost converters. These converters are the basic DC/DC converters. Now a days peoples utilize many applicanes which consume peak power . So the professor luo designed a new advanced DC/DC luo converter which uses voltage lift techniques. The advantages of luo converters are no parasitic problems and high gain. The luo converters are used in computer peripheral equipment, industrial applications.[3-4] Maximum power point tracking (MPPT) is used to track the maximum available power from the solar panels. Researchers develop more MPPT techniques such as perturb and observe method, voltage feedback method, incremental conductance method, fuzzy control method. Among these all methods, perturb and observe method is the easier and simpler method..[5-6].

II. PV CELL AND PROPOSED SYSTEM

The word Photovoltaic describe that the “photo” meaning light and “voltaic” means producing electricity and hence it produce electricity directly from the sunlight. A Photovoltaic cell is a semiconductor device that converts the light energy into electrical energy by photovoltaic effect. Photovoltaic array is a combination of photo cells connected in series or parallel. In this array, the DC power is generated by taking sun’s temperature and irradiance as input. The equivalent circuit diagram for Photovoltaic cell in Fig 1.

The power from the PV usually has low voltage hence the voltage needs to be boost. Many DC/DC converters are used to boost the voltage. The

newly developed luo converters are used now a days because of its small size and high gain. Meanwhile it uses voltage lift techniques for the high gain. In proposed system , positive output super-lift luo converters are modified in structure and coupled inductor is connected in the circuit

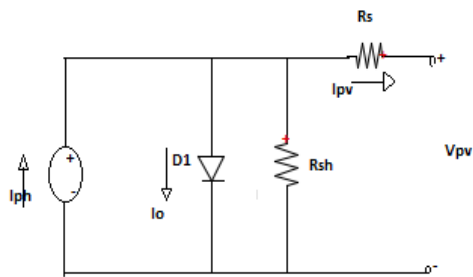


Fig. 1 Equivalent circuit diagram of PV cell

III. LUO CONVERTER AND INVERTER

Luo converters are one of the simplest form of dc/dc converters. Many series of luo converters are available now as 2lift to 192 lift luo converters. The luo converter mainly consists of two series , they are main series and additional series.

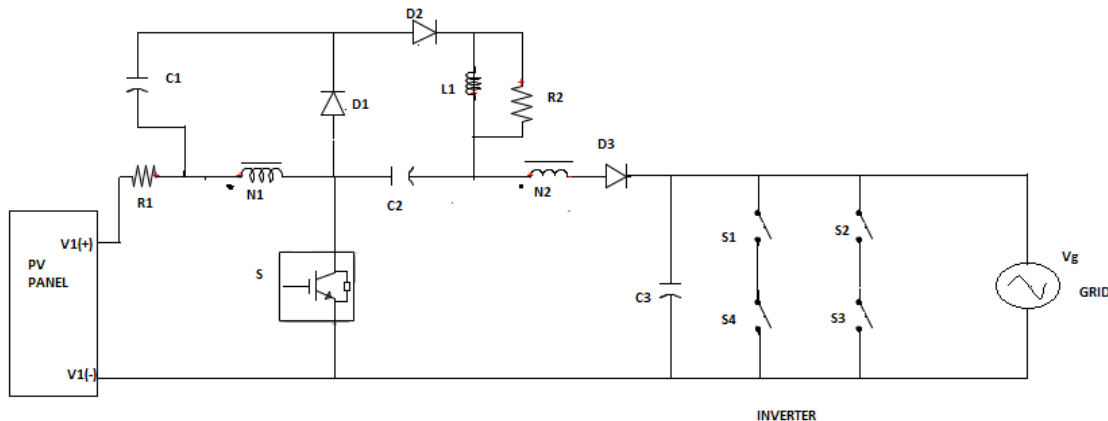


Fig.3 Circuit diagram of modified luo converter with coupled inductor

During switch ON(S=ON), the current flows in three paths 1.V1(+)-R1-C1-D2-L1-N2-D3-S1-GRID 2.V1(+)-R1-N1-C2-N2-C0-V1(-) 3.V1(+)-R1-N1-S-V1(-). During switch OFF(S=OFF), the current flows as V1(+)-R1-N1-C2-N2-D3-S1-GRID. Hence during switch ON and OFF, the current flows to the grid is not interrupted and provides continuous supply to the grid.

IV. MPPT TECHNIQUE

The maximum power point tracking are used to enhance the power obtained from the solar array. MPPT is the techniques that the grid connected

The main series consists of 2lift ,4 lifts etc and the additional series consists of 3 lifts,6lifts etc. Inverter is used to convert the dc to ac and the ac power is given to the grid. From the grid it is distributed to distributors. A practical grid connected system block diagram in Fig 2.

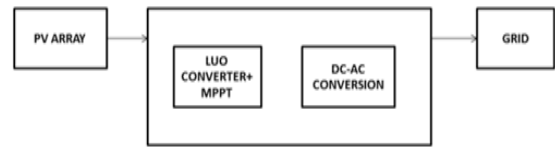


Fig. 2 Block diagram of grid connected system

The circuit diagram for the grid connected systems with modified luo converter with coupled inductor in Fig3.The coupled inductor is used for boosting the voltage and reduces switching loss.S1,S2,S3,S4 are the inverter switches.The switched capacitor allows controlled energy transfer from unregulated source to regulated output voltage.

inverters and other devices are use to get the maximum possible power from the photovoltaic devices. Researchers may implement different algorithms such as perturb and observe method, incremental conductance method , current sweep method, constant voltage method. Inproposedsystem ,we estimate the maximum power by means of perturb and observe method. It is easier and simpler method compare to all methods.

Perturb and observe method has a controller which adjusts the voltage by a small amount from the array and measures the power. If the power is increases means, further adjustments are tried until

the power no longer increases. It is also referred as a hill climbing method. The advantages are ease of implementation and provides top levefficiency

Table1: Parameters in the Simulation

S.no	Parameters	Symbo l	Value
1.	Input voltage to the converter	V_i	68V
2.	Output voltage	V_o	178V
3.	Capacitors	C0 C1 C2	1000uF 1.3mF 2Mf
4.	Coupled inductor	N1 N2	12T 15T
5.	Grid output voltage Grid output current	V_g I_g	230V 6A

V. SIMULATION DIAGRAM OF PROPOSED SYSTEM

The single stage grid connected modified luo converter with coupled inductor for PV systems is designed and simulated using MATLAB/Simulink in Fig 6. The parameters are listed in the simulation in Table1.

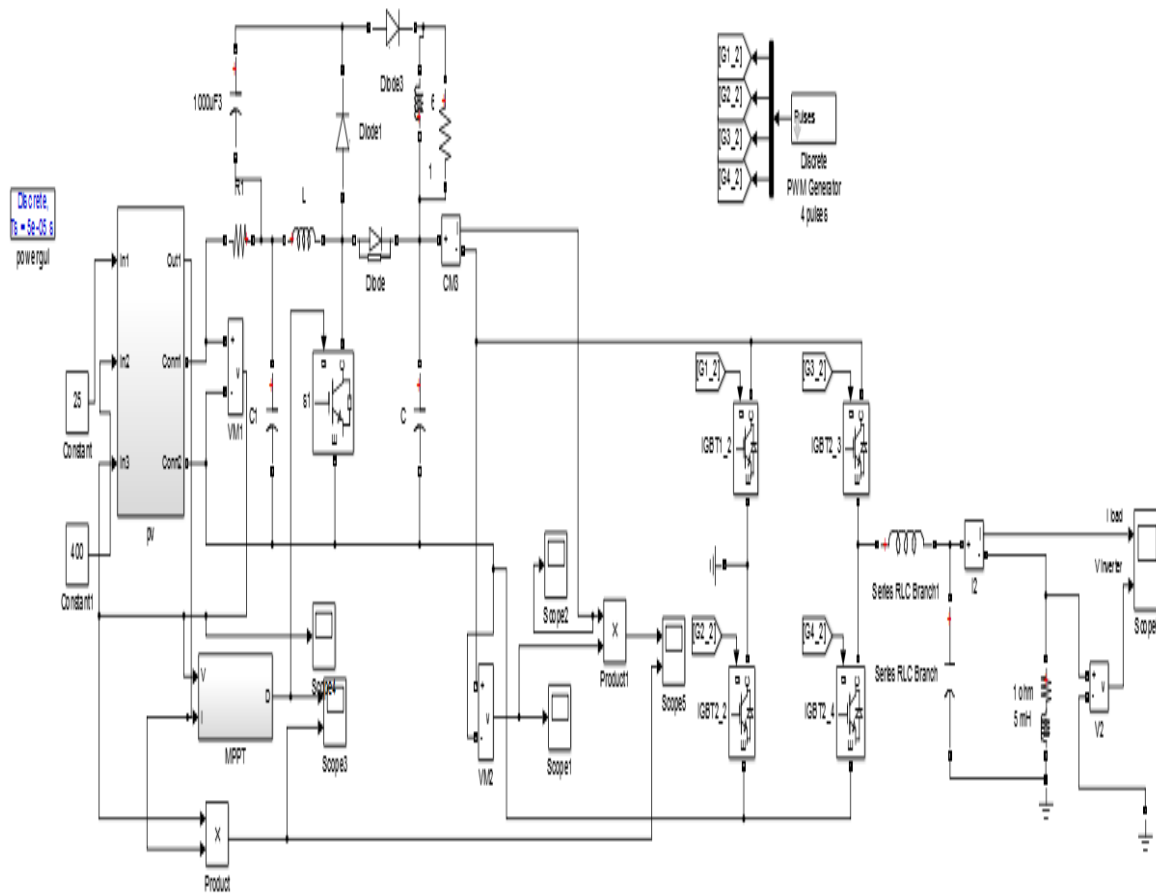


Fig.6 Simulation diagram

VI. SIMULATION RESULTS

The single stage grid connected luo converter with coupled inductor simulation results are shown

below. The converter input voltage in Fig 7, output converter voltage in Fig 8 and grid voltage and current in Fig 9.

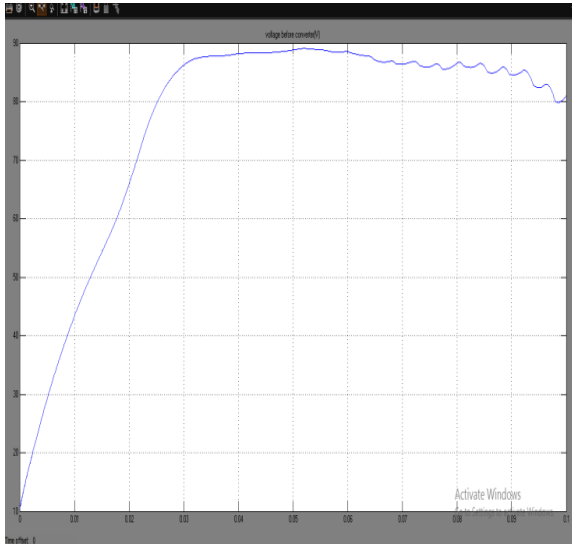


Fig.7 Converter Input Voltage

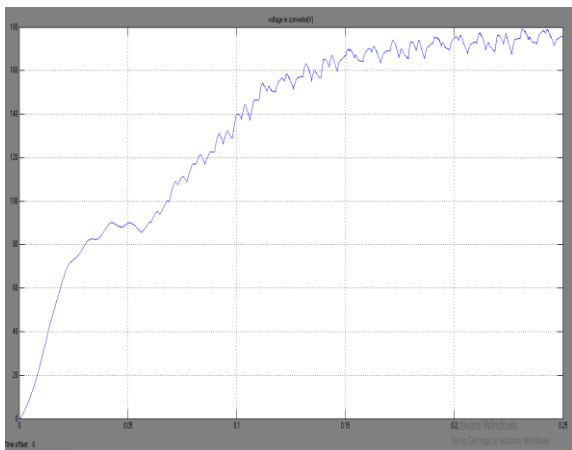


Fig.8. Converter Output Voltage

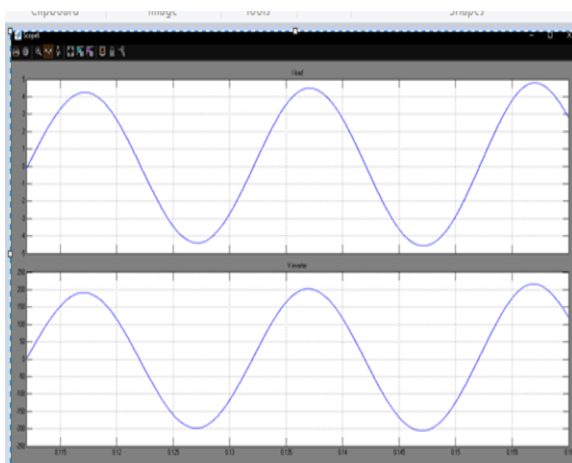


Fig.9 Grid voltage and current

VII.CONCLUSION

A high gain modified Luo converter with coupled inductor for PV system connected to a grid is presented. High gain is achieved by means of coupled inductor. From the simulation it is verified

that Luo converter increases the output voltage in geometric progression. The output voltage of 178V is gets from the input voltage of 68V. The current spike is also suppressed in the grid by means of coupled inductor and it also improves the efficiency.

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