

# Agrid Connected Single Stage High Voltage Gain Luo Converter with MPPT Technique

D. Thamizhthendral<sup>1</sup>, V. Ashokkumar<sup>2</sup>

<sup>1</sup>PG Student(PED),<sup>2</sup>Assistant Professor,

<sup>12</sup>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:**Maximum power point tracking, luo converter, voltage lift techniques.

## 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 going for renewable sources of power generation. PV becomes a better solution for these problems. The output voltage of the PV depends on temperatures, insolation etc. Hence PV power is efficiently transferred to grid, for this purpose a perfect converter and inverter 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 transfer 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 boost 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 people utilize many applications 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 describes that the “photo” meaning light and “voltaic” means producing electricity and hence it produces 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 is in Fig 1.

The power from the PV usually has low voltage hence the voltage needs to be boosted. 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 the proposed system, positive output super-lift Luo converters are modified in structure and coupled inductor is connected in the circuit.

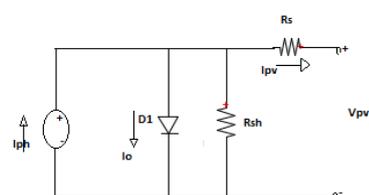


Fig. 1 Equivalent circuit diagram of PV cell

### III. LUO CONVERTER AND INVERTER

Luoconverters are one of the simplest forms 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. The main series consists of 2lift, 4 lifts etc and the additional series consists of 3 lifts, 6 lifts 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.

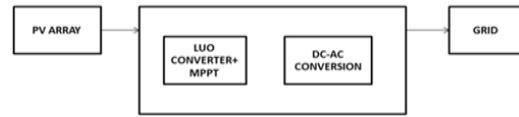


Fig. 2 Block diagram of grid connected system

The circuit diagram for the grid connected systems with modified Luo converter with coupled inductor in Fig 3.

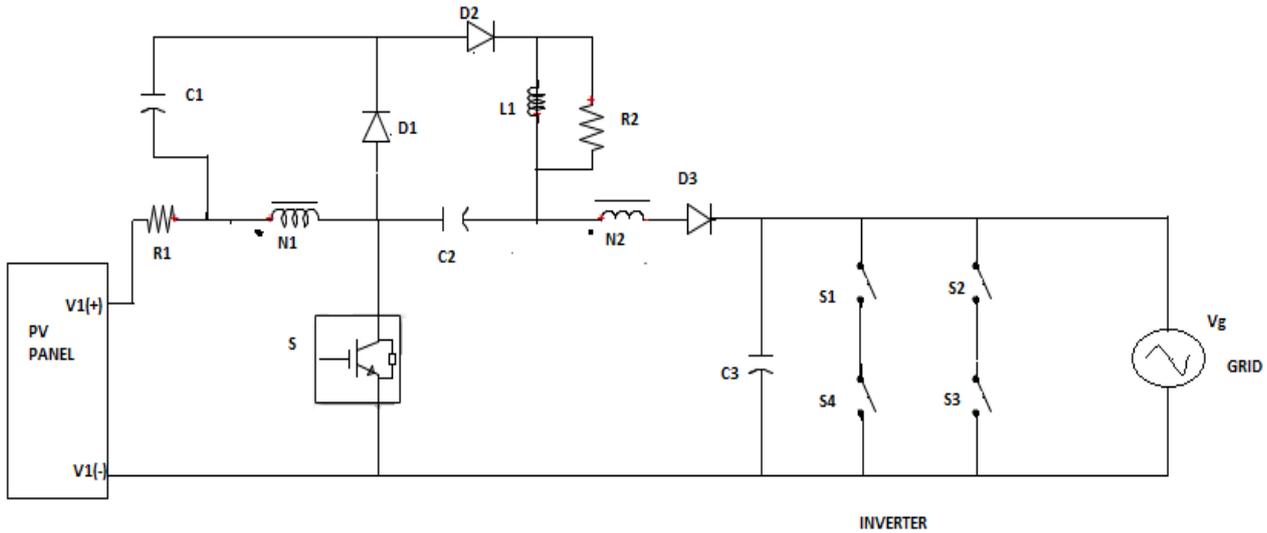


Fig.3 Circuit diagram of modified Luo converter with coupled inductor

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 is used to enhance the power obtained from the solar array. MPPT is the techniques that the grid connected inverters and other devices are used 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. In the proposed system, we estimate the maximum power by means of the perturb and observe method. It is easier and simpler method compared to all methods.

The 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 increases, means, further adjustments are tried until the power no longer increases. It

is also referred to as a hill climbing method. The advantages are ease of implementation and provides top level efficiency.

### V. SIMULATION 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 Table.

TABLE 1: PARAMETERS IN THE SIMULATION

S.no	Parameters	Symbols	Value
1.	Input voltage to the converter	$V_i$	68V
2.	Output voltage	$V_o$	178V
3.	Capacitors	$C_0$	1000uF
		$C_1$	1.3mF
		$C_2$	2Mf
4.	Coupled inductor	$N_1$	12T
		$N_2$	15T
5.	Grid output voltage	$V_g$	230V
	Grid output current	$I_g$	6A

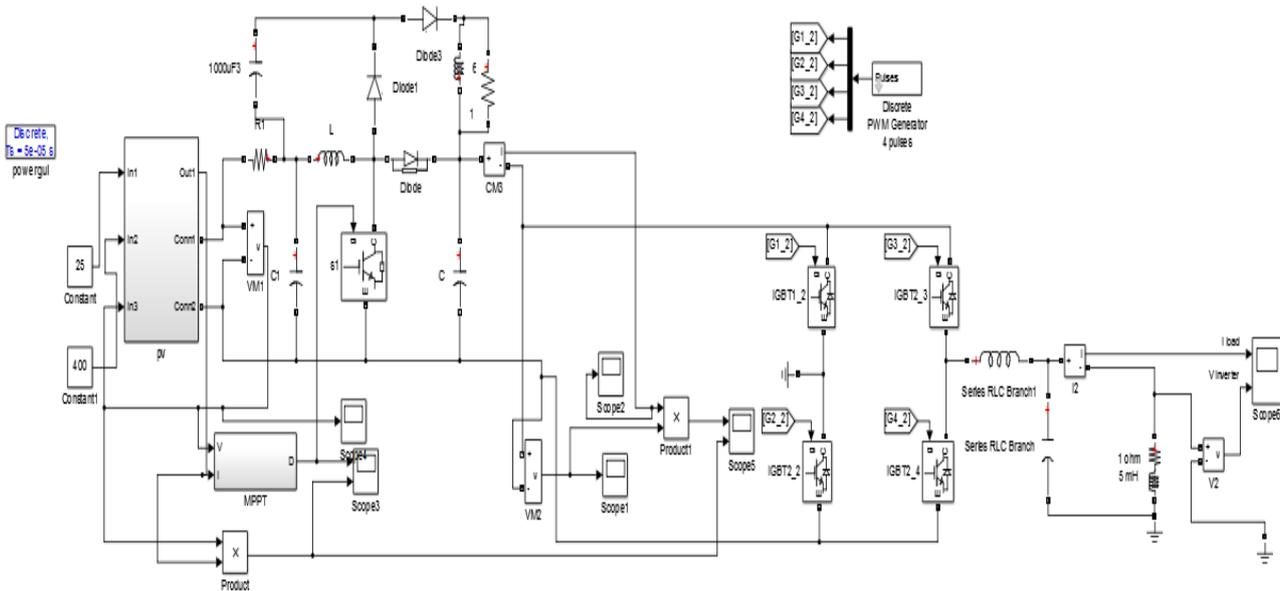


Fig.6 Simulation Diagram

VI. SIMULATION RESULTS

The single stage grid connected luconverter with coupled inductor simulation results are given. The converter input voltage in Fig 7, output converter voltage in Fig 8 and grid current and voltage in Fig 9.

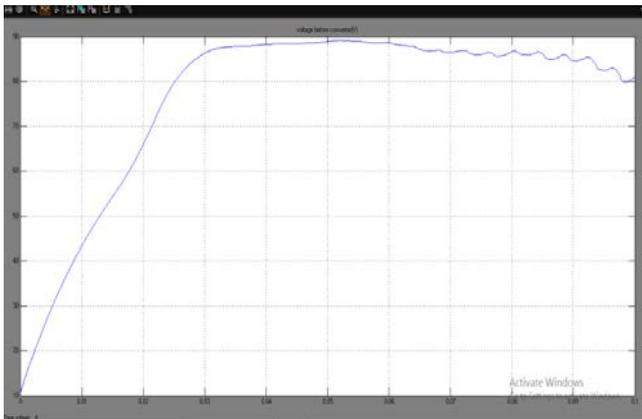


Fig.7 Converter Input Voltage

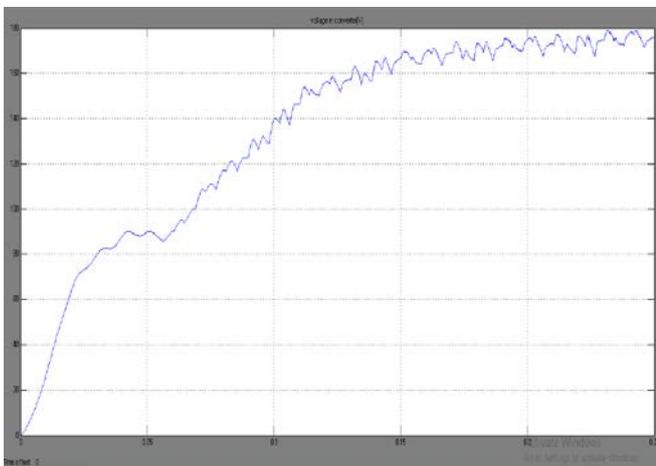


Fig.8. Converter Output Voltage

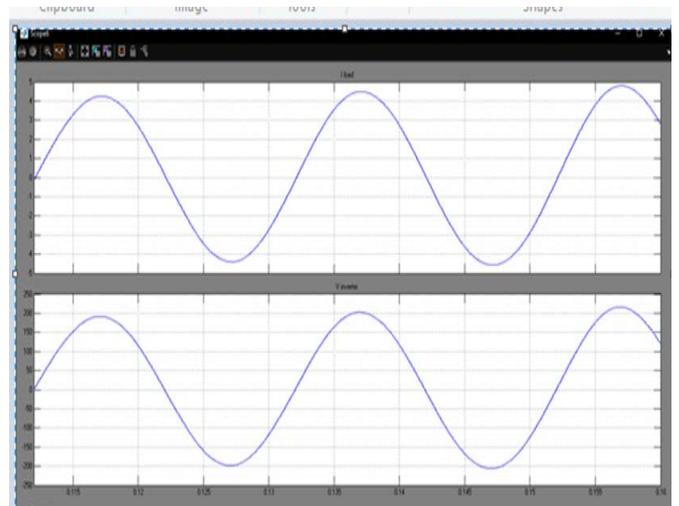


Fig.9 Grid voltage and current

VII. CONCLUSION

A high gain modified lu 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 lu 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.

REFERENCES

- [1] T. Sreekanth, N. Lakshminarasamma , and Mahesh K. Mishra, "A single stage grid connected high gain buck-boost inverter with maximum power point tracking", IEEE Trans Energy Convers, Vol.32, No.01, 2017.
- [2] G. Justin Sunil Dhas, D.AntoSahayaDhas, and Sreesna M K , "Positive output elementary superliftluo converter for PV

applications”, International conference on innovative engineering technologies , Aug 2016.

- [3] M. Pradeep Chand and G. Ramesh ,”Design of new positive output super-lift Luo converter for solar input in comparison with different DC-DC Converters”, International research journal of engineering and technology , Vol 03, Issue:09 , Sep 2016.
- [4] V.Usharani and R.Agasthiya,”Enhanced MPPT Technique for DC-DC Luo converter using model predictive control for photovoltaic systems”, International journal of engineering research and development, Vol 11, Issue 01, Jan 2015.
- [5] He, Y.; Luo, F.L., “Positive output super-lift converters,” IEEE Trans.Power Electron., vol.18, no.1, Jan 2003, pp.105-113.
- [6] S.K. Changchein, T.J. Liang, J.F.Chen ,L.S.Yang ,”Step-up DC-DC converter by coupled inductor and voltage lift technique, IET Power Electron,2010,Vol 3,Iss 3,pp. 369-378.