# Solar DC-DC boost Converter Fed DC Drives using fuzzy controller

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***Abstract* -This Paper deals the modeling, simulation and hardware prototype of Positive Output of Luo converter (POLC) with the PV input. POLC is a type of DC-DC boost converter in which the voltage boosting in fast progression. The aim of this work is to model and design a fuzzy logic controller to drive PV and positive output Luo converter (POLC).The simulation evaluation of the positive output Luo converter is designed and simulated in Mat lab/Simulink.**

***.Index Terms*— POLC, PV, DC –DC converter, BLDC motor**

## I. Introduction

Evolution of conversion technique growing enormously, while operation have been mostly applied in manufacturing like as dc drives, computer applications and medical manufacturing equipment's. The final measured voltage profile of pulse generated signals depended upon DC-DC conversion have be modified by altering the ON / OFF duty periods [6]-[7]. Therefore the voltage lift technology is a famous technique and it is applied in PCB circuit design. This technology successfully reduces the cause of parasitic components and largely boosts the final output voltage. Hereafter these converters function of DC boosting voltage conversion with larger power , larger efficiency and larger DC voltage with batteries are used in the networks. In proceed to work the system in off grid the reduced ripples [12][13].Summarizing with existing converters topology, this work proposed converters can mostly suggested and it to be implemented for boosting the final output voltages part by part along a arithmetical sequence and achieve larger voltage gains.

These DC converters have various parts based upon their power step numbers, like as the preliminary technique (single power step), re-lift technique(two power step), triple-lift technique(three power step) etc.[4]. Because of the time changes and switching character in the power converters, their fixed and variable character turn into larger non-linear.[15][17]. A strong control for DC converters forever maintain linearity in random operating scenario. However, strong behavior in consideration of elimination of load changes, input voltage changes and even component doubts is always needed for a classic control technique.

In this work, the Solar array is placed as the major power production in the proposed technique. Because of the enormous demand for generations, tube control unit was developed. The paper is organized as follow; in topic 2, overall structure and general properties of PV panels and batteries and then Fuzzy logic Controller with proposed networks is explained and relevant statistical functions are explained. Additionally, specifications of equipment used in this system are reported and boost capability rates with existing system and comparison graph are explained.

## II. Solar Photovoltaic System

The capacity for conducting operations to transfer electromagnetic rays straightly into conventional energy. The PV system is the technique metals produce electrons while light glows on them. The produced electrons named as photoelectrons.

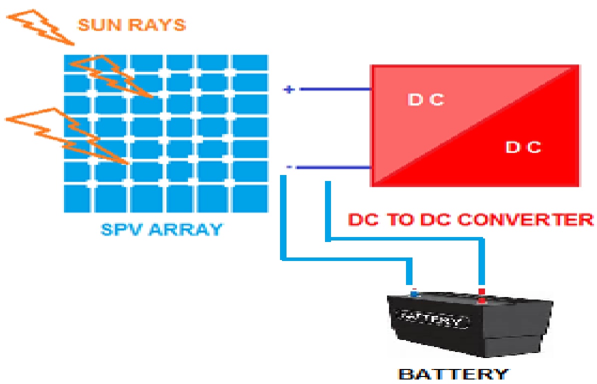


Figure 1. Solar Photo Voltaic (SPV)

$$I_{sh} = I_{Ph1} \quad (1)$$

$$V_{oct} = V_{Ph1} \quad (2)$$

Whereas,

$I_{sh}$- denotes that short circuit input current

$I_{Ph1}$ - denotes that input phase current

$V_{oct}$ - denotes that open circuit input vol`tage

$V_{Ph1}$ - denotes that phase input voltage

SPA – Solar Photo Voltaic Array

## III. MODIFIED LUO CONVERTER WITH FUZZY INTEGRATION

The positive output converter which uses voltage lift technology in their stage by stage process is applied in electronic designs. This methodology effectively minimizes the hazards of parasitic parameters and larger boost output voltage. The outcome of converters operation for DC boosting voltage function with larger power , efficiency , voltage with minimized ripples [12][13].Over viewing with conventional device operation methodology, this model proposed scheme Tobe most preferable and implemented to increase the output voltages efficiently and successfully with algebraic sequence for attain larger voltage output

Reason of the switching behavior and time dependency of the DC converters, their variable and fixed character shows larger unstable in manner. [17]. A dynamic compensation for DC converters anyways it assumes linear in nature and strong working environment. However, a strong outcome in the ways of elimination of load changes, input voltage alterations

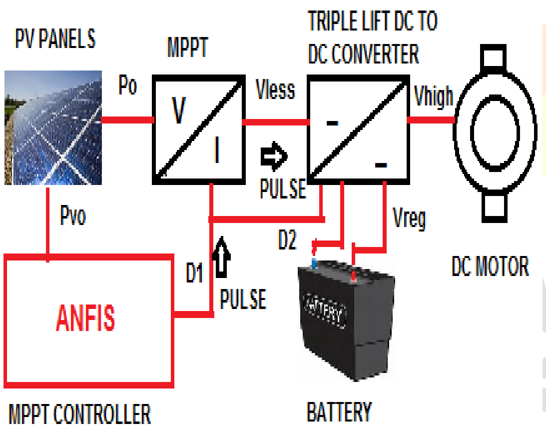


Figure 2. Block diagram of Positive Triple Lift Luo converter

The diagram shows that proposed triple lift method is modeled in Figure.no.5 and it contains two semiconductor switches S1 and S2, four inductors L1l, L2ll, L3l and L4l, five capacitors C1l, C2l, C3l andC0l and freewheeling diodes five.

Capacitors like as C1l, C2ll and C3lexecuteits behavior to lift the capacitor voltage Vcl by three times the input voltage VIl. L3l and L4lto do the function as steps joints to streak the three capacitors C1l, C2l and C3l and lift the voltage of the capacitor Vcl up.

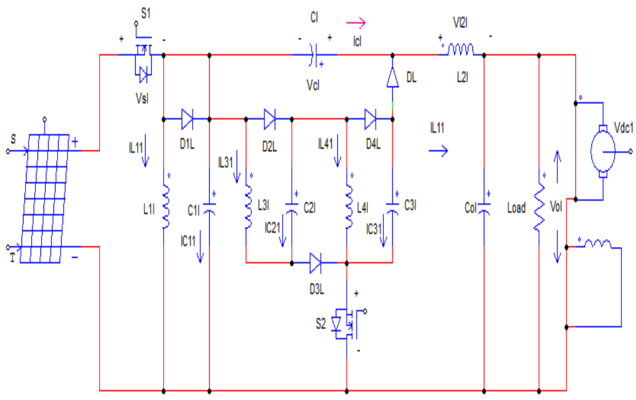

Figure 3. Circuit diagram of Luo converter

The figure.no.7 shows that the two modes are operated with respect to two switches S1 and S2,four inductors L1l,L2l,L3land L4l, five capacitor COl,C1l,C2l,C3l,freewheelingdiodes five [3].

Capacitors C1l, C2l, C3l perform its behavior to lift the voltage of the capacitor VCl by three times the input voltage V1.L3 and L4 perform the steps joints to phase.

The current iL2l rises with effect to the relative switches are in ON switching period kTl. And it falls with neighbor to the corresponding switches are in OFF switching period (1-kT). The output of the voltage and output of the current are

$$V_{011} = \frac{3V_{1a}}{1-Kl} \tag{3}$$

$$I_{011} = \frac{(1-kl)I2l}{3} \tag{4}$$

The voltage transfer gain in continuous mode is

$$M_{T11} = \frac{V_{01l}}{I_{01l}} \tag{5}$$

The average branch current is

$$IL_{12l} = \frac{KI_{01l}}{1-Kl} \tag{6}$$

$$IL_{21} = I_{011} \tag{7}$$

$$IL_{31} = IL_{41} = IL_{11} + IL_{21} \tag{8}$$

$$IL_{31} = \frac{I_{01l}}{1-Kl} \tag{9}$$

TABLE I. MODIFIED POSITIVE TRIPLE LIFT LUO COMPONENT VALUES

| Parameter name | Symbol | Value |
|---|---|---|
| Input Voltage | Vin | 20 |
| Line Capacitance | C1l | 20e-6 F |
| Line Capacitance | C2l | 20e-6 F |
| Line Capacitance | C3l | 20e-6 F |
| Line Capacitance | C4l | 20e-6 F |
| Line Inductance | L1l | 1 e-3 H |
| Line Inductance | L2l | 1 e-3 H |
| Line Inductance | L3l | 1 e-3 H |
| Line Inductance | L4l | 1 e-3 H |
| Line Inductance | L5l | 1 e-3 H |
| Line Diode | D1l | 0.8 V |
| Line Diode | D2l | 0.8 V |

| | | |
|---|---|---|
| Line Diode | D3l | 0.8 V |
| Line Diode | D4l | 0.8 V |
| Line Diode | D5l | 0.8 V |
| Line Diode | D6l | 0.8 V |
| MOSFET | Mtl | 0.5e3 |
| MOSFET | Mtl | 0.5e3 |
| Load resistance | Lrl | 0.2 OHM |

The branch input current in ON period, it is just equal to L1lwhen there is OFF condition. The current of the branch Capacitor C1l is equilibrium to L1lwith relative to switches in OFF condition. The peak steady state characteristics, the average mean of the charging capacitor C1lnot vary.

## IV. FUZZY LOGIC CONTROLLER

Fuzzy Logic is an adaptive system that is performs very similar to a FLC system, when the overall outcome of the suggested controller is based upon the fuzzy logic rules during inputs. Fig. 6 shows that two input one output five layer structure. The five layer structure inputs are Infmf1 (error) which was obtained as (Vdcl_thres ~Vdcl), in fmf2 (deviation of error) and overall output is a regulated DC voltage. Every output and input parameters have linguistic functions are such as PS, NS, PL, NL). Therefore, in this suggested ANFIS systems, structures are employed in following figure no.6.

The error in the input voltage is given by

$$E' = V_{re} - V_o' \qquad (10)$$

Where,

Vre – Voltage reference

VO – Output Voltage

The error variation in the output side is given by

$$V_e = e_{k1} - e_{k1-1} \qquad (11)$$

Where,

Ve – error variations

$e_{k1}$ – error coefficient

The duty cycle deviations is given by

$$D_{dev} = \frac{\sum_{i=1}^{2} wfC1}{\sum_{1=2}^{2} wf} \qquad (12)$$

Where,

$D_{dev}$ – Duty Deviations

Wf – Weighting factor

C1 – centroid constant

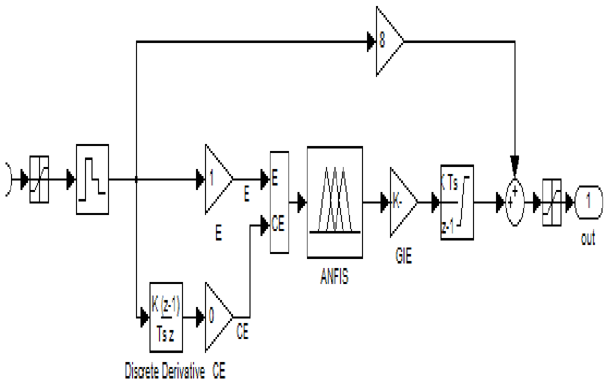


Fig 4 Simulated Matlab model

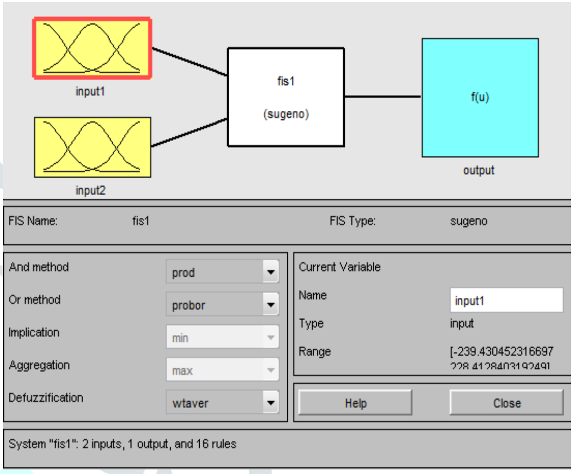


Fig 5 Sugeno creation Mat lab model

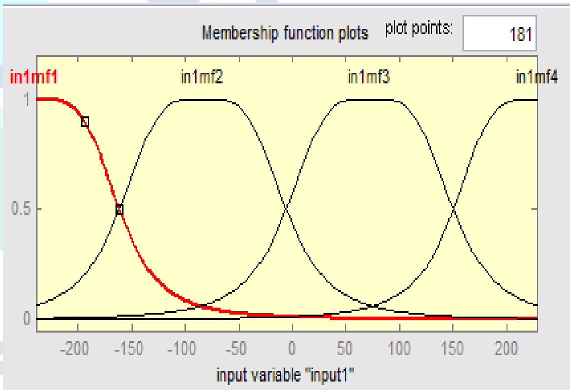


Fig 6 Membership function Mat lab model

TABLE 2. BLDC MOTOR SPECIFICATIONS

| **Parameter name** | **Value** |
|---|---|
| Rotor Inertia (kg*m^2) | 0.089 |
| Friction | 0.005 |
| Pole pairs | 4 |
| Back Emf flat area | 120 degrees |
| Resistance | 0.2 |
| Inductance | 8.5e-3 |

## IV. SIMULATION RESULTS

The modeling and simulations are completed on the suggested triple loft concept with components, tables and figures are plotted with comparison. The realistic performance of suggested controller for the triple lift concept is analyzed in Mat lab/Simulink.

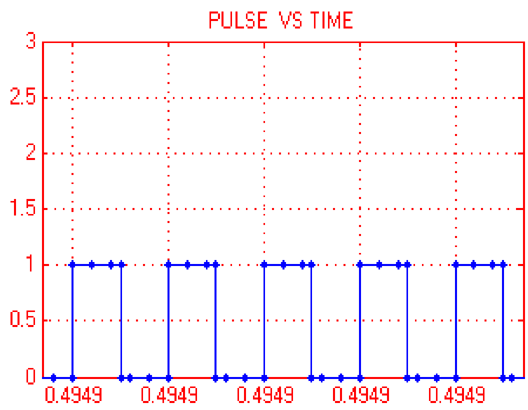


Fig 7 Gate pulses for dc to dc converter

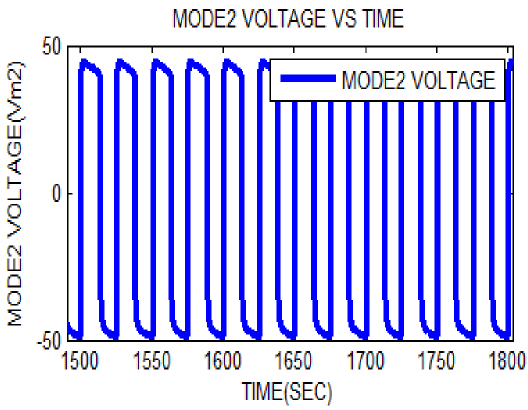


Fig 11 Mode2 Voltage for converter

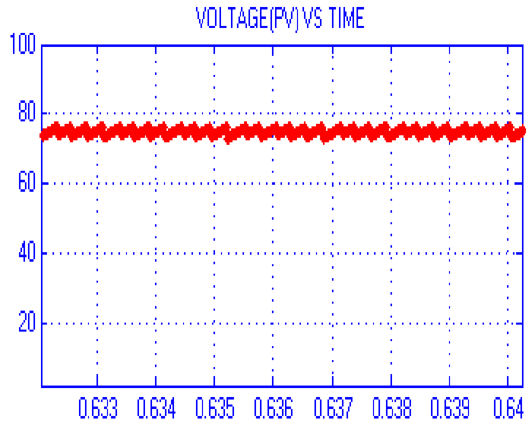


Fig 8 PV Voltage for dc-to-dc converter

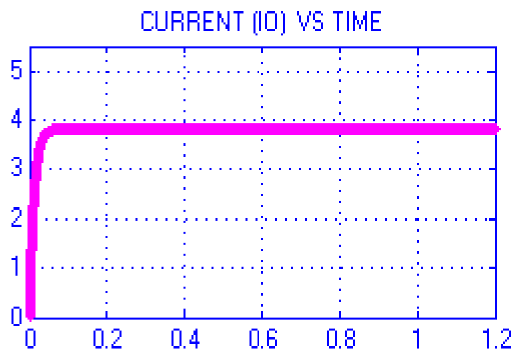


Fig 12Output Power for converter

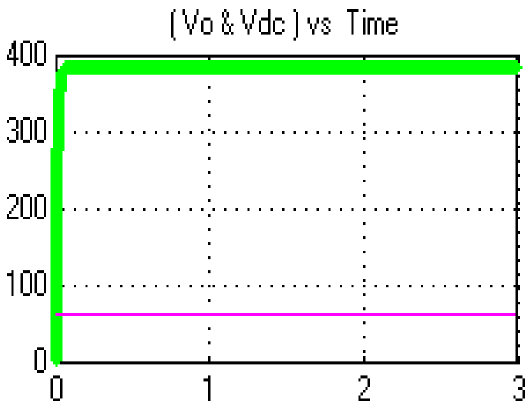


Fig 13 Voltage Comparison for dc to dc and converter

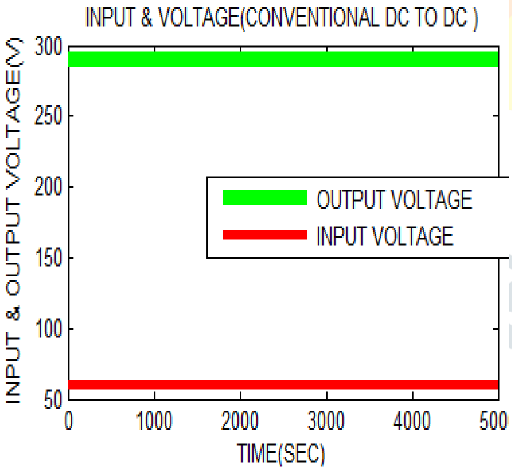


Fig 9 Mode1 Voltage for dc-to-dc converter

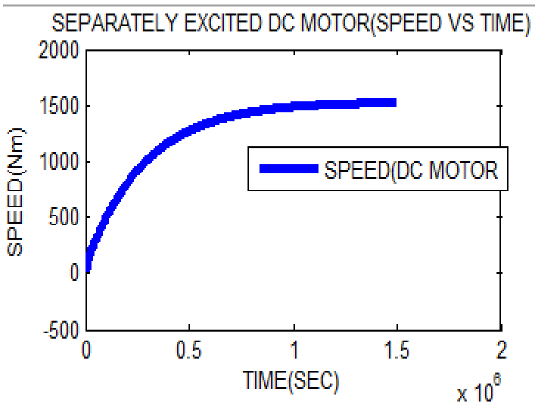


Fig 14 separately excited DC motor speed

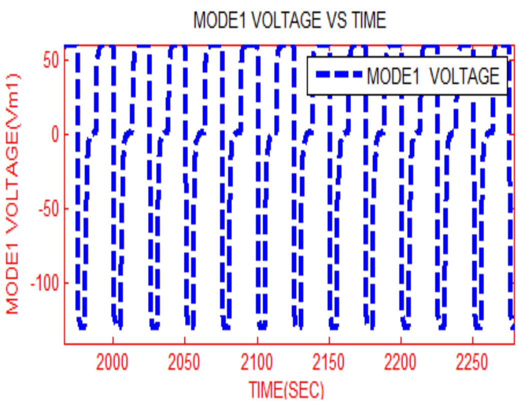


Fig 10 Mode1 Voltage for converter

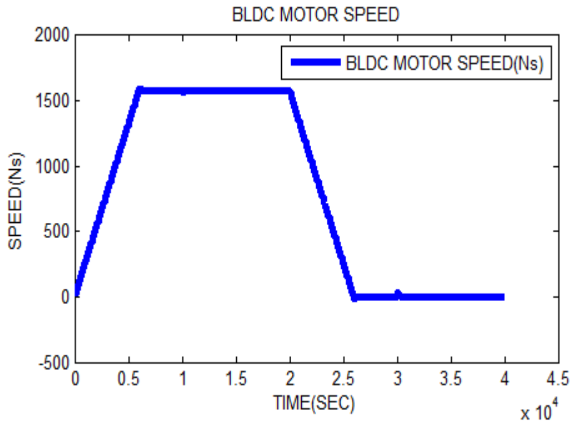


Fig 15 BL DC motor Speed

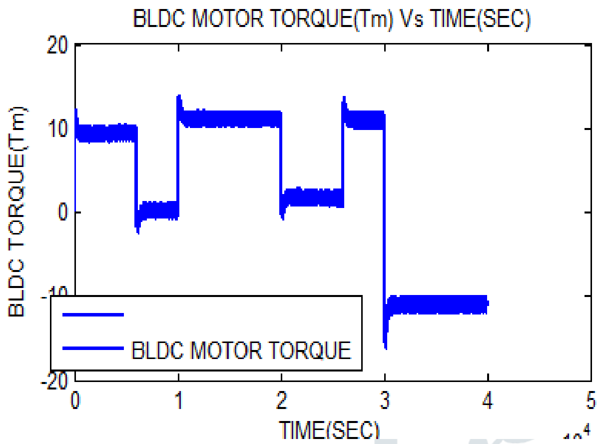


Fig 16 BLDC motor Torque

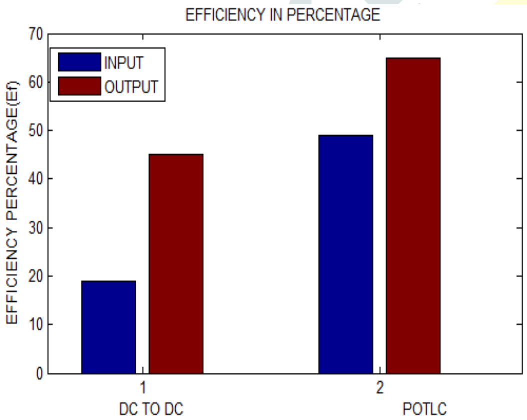


Fig 17 Efficiency with proposed POTLC

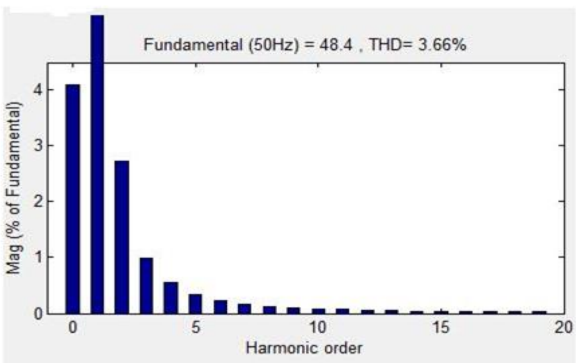


Fig 18 THD percentage for converter

TABLE 4 COMPARISON BETWEEN CONVENTIONAL AND PROPOSED METHOD

| S.No | Parameters | Conventional | Proposed |
|---|---|---|---|
| 1 | Input Voltage | 60 | 60 |
| 2 | Output Voltage | 290 | 390 |
| 3 | Output Current | 2.456 | 3.823 |
| 4 | Output Power | 713 | 1482 |

Figure no.18 indicts that the suggested controller are well suitable for boost the given voltage with reduced ripple and successful manner. With respect to the TABLE 4 clearly indicate the comparison results of existing system with suggested system in a well manner.

## V. CONCLUSION

The suggested controller (POLC) reacts the voltage conversion from given voltage to voltage boosted with reduced ripples. The fuzzy control technique has verified to be dynamic and it has been evaluated with high voltage and steady state region, phase and load deviations. The application of suggested controller in PV network generates voltages boosting in algebraic progression. It produces output voltage of 400V for the input voltage of 70V from solar pv system.

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