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PV Panel with ANN Controlled Integrated Converter Coupled Novel High Quality Charging Scheme Using RFID

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ABSTRACT

The integrated operation of BOOST ZETA converters and a single phase bidirectional inverter for EV charging applications is the subject of the presented paper. An output voltage of the DC-DC converter is referred as "Boost converter" that might be more, less than or equal to the input voltage. Using PWM signals, the bidirectional inverter will convert the DC voltages to AC voltages during the grid connection operation. The inverter serves as a converter during rectification operations, converting AC electricity to DC voltage.

Keywords: BOOST-ZETA converters, LUO converter, total harmonic distortion (THD), Boost Luo converters

1. Introduction

Most industrialized nations' governments have prioritized reducing greenhouse gas emissions over the past few eras in order to address climate change. The impact of climate change on society is definitely harmful, according to science. Fossil fuels have been the world's main source of energy, which has significantly raised global temperatures and increased air pollution. EVs and their charging infrastructure, however, place a substantial demand on the power grid and should not be viewed solely as a passive load but rather as a fully integrated active power resource. It's crucial to describe the existing power system's growing changes and the framework's problems for the future power system in order to comprehend the goals of this research paper.

2. Recent Works

Emin Ucer et al [2019] proposes a key element in facilitating the shift to electric vehicle (EV) technology has been the implementation of public charging infrastructure networks, which must continue to stimulate the uptake of this technology. Long distance EV travel is made possible by DC fast charging (DCFC), which also speeds up customer convenience by reducing charging times. However high mileage fleets may also be electrified thanks to DCFC.

Mohammad Ekramul Kabir et al [2020] suggests the combat global warming of the idea of a "smart city" pushes for environmentally friendly technologies. In this direction, transportation sector has been undergoing a paradigm transition as well as shifting to electric vehicles (EVs) represents a tremendous opportunity for reducing carbon emissions. Hence, a number of obstacles prevent the predicted EV penetration. Nevertheless, these challenges also include low

duration of EVs, reduced charging rates and a shortage of widely spread charging stations, which all enhances drivers' range anxiety.

Thomas Morstyn et al [2020] outlines a new convex optimization method for organizing the charging of electric vehicles that takes battery voltage growth and its corresponding limits into account. However, the maximum charging power is constrained by battery voltage rise, which is a crucial factor to take into account

3. Proposed Work Explanation

The performance of several power electronic converters with RL loads is analyzed in this paper in order to lower total harmonic distortion. The LUO converter, Boost converter and Z SOURCE converter are the power converters that were examined. In order to choose the best power electronic converter for an electric vehicle propulsion system, it is important to determine which converters have lower total harmonic distortion (THD) and higher levels of efficiency. Using an input voltage that changes from above to below output voltage, the boost converter, a DC/DC converter topology that produces a positive controlled output voltage.

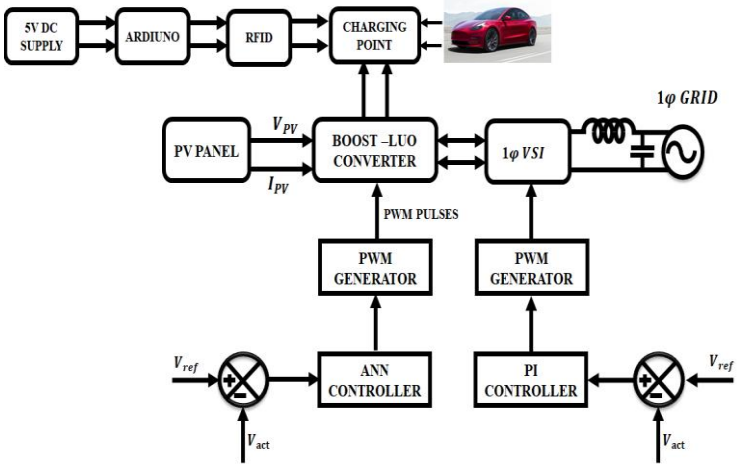


Figure 1: *Block diagram for the proposed system*

Another choice for controlling an unregulated input power supply is the LUO converter. Therefore, this analyze and identify the most dependable DC–DC converters in this study that are utilized in low power applications and that produce the highest output with the lowest THD.

3.1. PV System

A number of parallel and series combinations of Photovoltaic modules, a tracking controller and power converters such a DC-DC converter and inverter make up PV system used for power conversion.

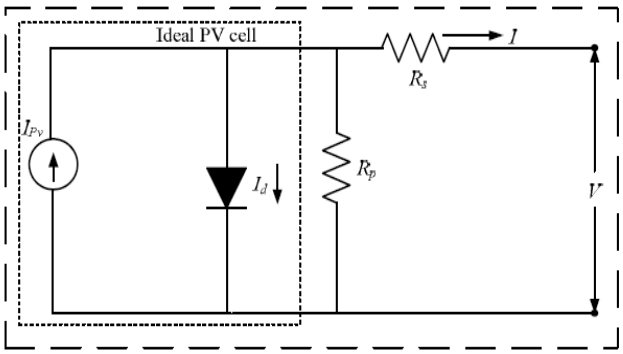


Figure 2: *Equivalent circuit of Photovoltaic cell*

The PV system constitutes current sources, diode Shunt resistanceR_{sh} Series ResistanceR_s, Shunt Resistance R_{sh} represent the cell surface leakage through the edges.
Because the shunt Resistance is typically high in all applications, it can be minimized by applying three criteria.

Short circuit current ($V = 0,\ I = I_{sc}$)

Open circuit voltage ($I = 0, V = V_{oc}$)

Maximum power of current (I_{mp}) as well as voltage (V_{mp}) at following equation are as follows,

$$I_{sc} = I_{ph} - I_0\left[exp\left(\frac{I_{sc}.R_S}{A}\right) - 1\right] \quad (1)$$

$$O = I_{ph} - I_0\left[exp\left(\frac{V_{oc}}{A}\right) - 1\right] \quad (2)$$

$$I_{pm} = I_{ph} - I_0\left[exp\left(\frac{V_{pm}+I_{pm}R_S}{A}\right) - 1\right] \quad (3)$$

$$0 \approx I_{sc} - I_0 exp\left(\frac{V_0}{A}\right) \quad (4)$$

Hence

$$I_0 = I_{sc}\ exp\left(\frac{-V_{0c}}{A}\right) \quad (5)$$

3.2. ANN Controller

An information processing system with some performance traits in common with biological neural networks is an artificial neural network. The development of artificial neural networks, which are expansions of accurate models of human cognition or neural biology is predicated on idea that information processing happens at a variety of small, basic units known as neurons.

4. Results and Discussion

MATLAB/Simulink is used to simulate the combined functioning of Boost Luo converters and a bidirectional inverter. The various input and output waveforms are showed below.

Article Title: PV Panel with ANN Controlled Integrated Converter Coupled Novel High Quality Charging Scheme Using RFID

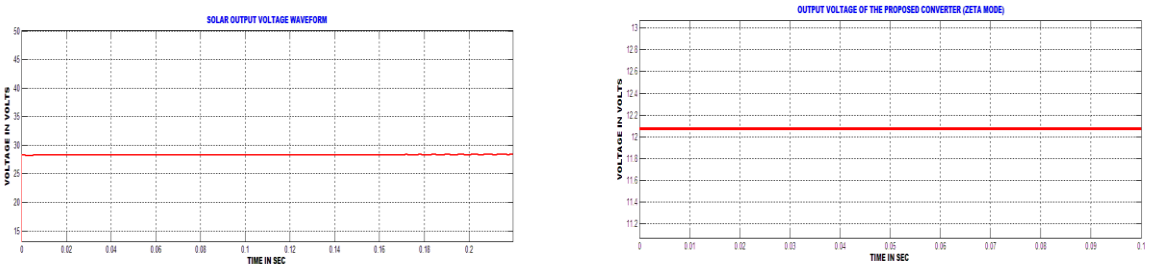


Figure 3: a*) PV System Output voltage b) From LUO converter a Battery operated voltage*

The Figure 3) a shows an output voltage from Photovoltaic system, this voltage is given to the suggested Boost Luo converter, the PI controller produces PWM pulses to the converter. Figure 3) b shows the battery converter i.e LUO converter output voltage waveform.

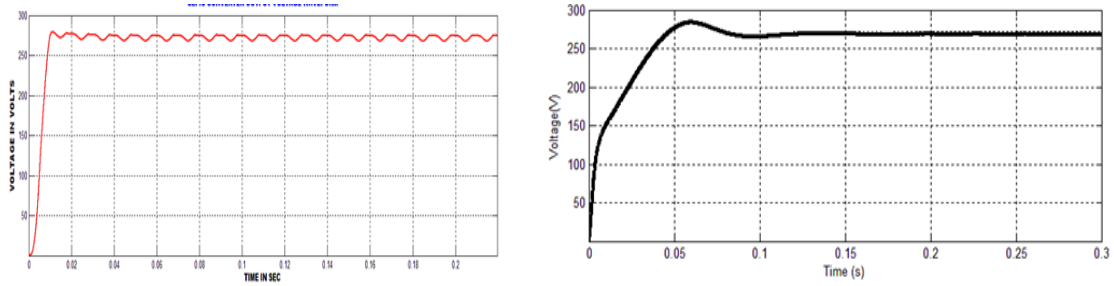


Figure 4: *a) Boost converter mode output voltage waveform b) Boost converter mode output voltage waveform with Fuzzy controller*

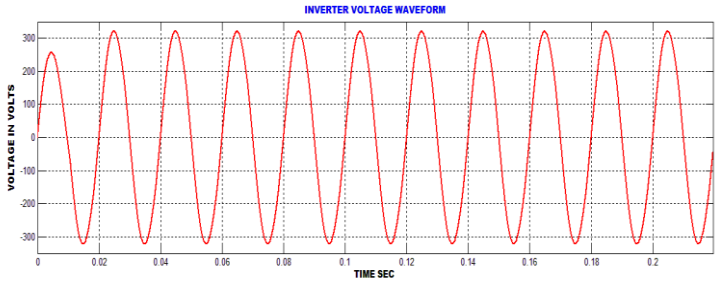
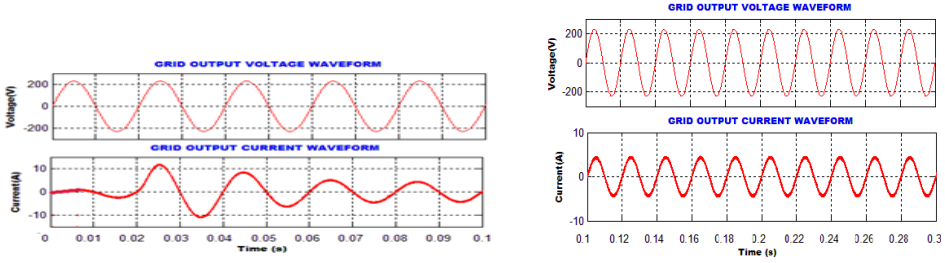


Figure 5: *Single phase voltage source inverter output waveform*

Considering Figure 5 single phase bidirectional grid connected inverter output voltage waveform has been illustrated.



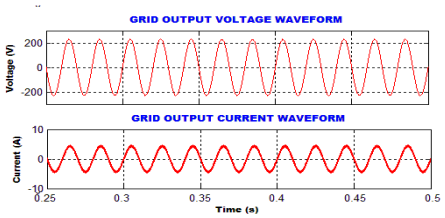


Figure 6: *a) Current waveform and Grid voltage during starting b) current waveform and Grid voltage during fuzzy working c) current and Grid voltage under grid interactive mode.*

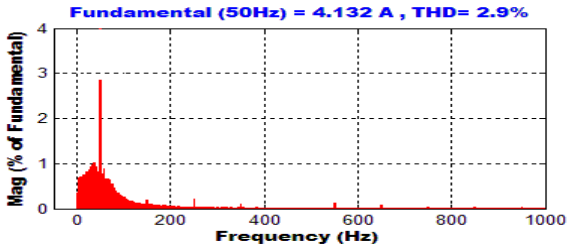


Figure 7: *THD result of the grid current*

Single phase Photovoltaic inverter functioning for both grid connected as well as grid isolated modes has been provided a comprehensive control strategy in this section.

4.1. Hardware Output

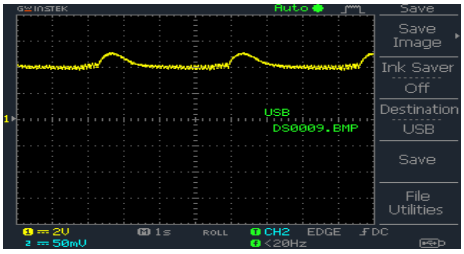
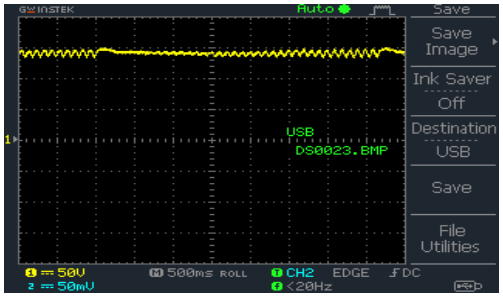


Figure 8: *Input voltage from the solar panel*

The output voltage from hybrid energy system has been shown in Figure 8 and higher order ripples are present due to the renewable energy sources' oscillatory nature. This voltage is given to the converter, this converter will reduce the ripples.



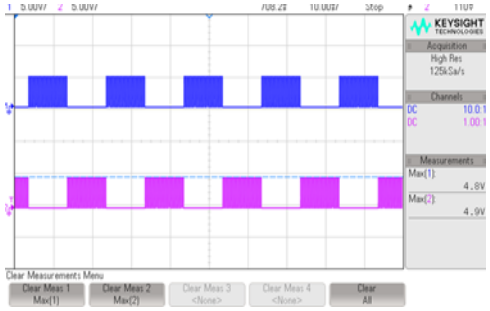


Figure 9: *Converter output voltage* **Figure 10:** *PWM pulses to the inverter*

Figures 9 and 10 depict the voltage output from the converter and PWM pulses with 180 degree phase shifts that were applied to the voltage source inverter, respectively.

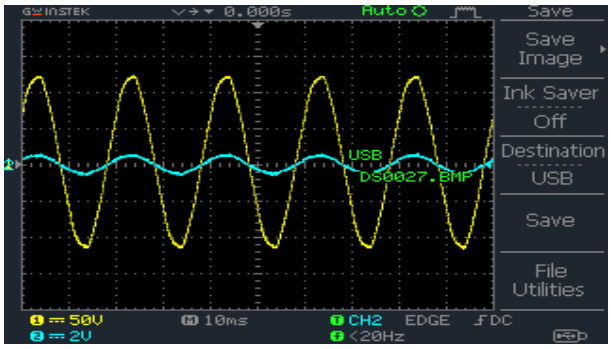


Figure 11: *Inverter output voltage*

Because the voltage injected into the grid has to be sinusoidal, Figure 11 depicts an inverter output voltage with an inductive filter.

5. Conclusions

The PI Controller method is the maximum power point tracking algorithm that has been employed. It deals with affecting a duty cycle for achieving maximum power. Operating DC loads is much simpler than operating AC loads since an integration of AC loads necessitates frequency matching AC-AC converters in addition to power factor concerns, grid synchronization, grid stability challenges and other issues.

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