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Improvement of Dynamic Characteristics using ANN Controlled Interleaved Buck Boost Converter Inverter based Solar System

T. Sundar[1]* and K. Umapathy[2]

[1]Department of EIE, Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya SCSVMV University, Enathur, Kanchipuram – 631561, Tamil Nadu, India; Kanchipuram.sundar_151@yahoo.co.in
[2]Department of ECE, Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya SCSVMV University, Enathur, Kanchipuram – 631561, Tamil Nadu, India; Kanchipuram.umapathykannan@gmail.com

Abstract

Interleaved buck boost converter is a good interface between PV array and inverter. The Main part of the research is as designing the model and gets a simulated result. An improved model of ANN with controls the solar energy power is applied in the converter of buck boost interleaved. A parallel system of arrangement is used in the model of converter so as to reduce the uncertainty of the direct flow of current of the output source. Using solar power the direct current flow is increased with the help of converter boost. By the model of unique phase bridge inverter, alternate current is used in increase the power of direct current by 50 Hz. The objective of this work is to improve dynamic response of closed loop system using ANN controller. The Block diagram and case studies are explained in details.

Keywords: Artificial Neural Network (ANN), Direct Current Distribution and Alternate Current Distribution, Interleaved Converter, Renewable Energy

1. Introduction

In the energy production area the Renewable energy sources is a challenge. The industrial areas and academicians applied for neat and natural power sources using solar energy, tidal energy etc., as many in Direct Current micro grid converter or DC nano grids converter. To balance the generation of the electricity and the consumption rate of the power system which lies between the solar source and wind power energy such as photo voltaic system in storage distribution. As a part of survey the system requirement was attended by applying many of the modified configuration systems and topology converters. The multi converter system and multi port systems where interlinked with many input source of powers to maintain the renewable energy source. A Direct to Direct Current change is applied with input sources to connect system of converters as the approach. This type of converters has advanced results in the managing power and as to control the entire process. Whereas this results very low power generation which leads to a maximum cost with material requirement. The multi input and multiple port converters where interested in very recent past such as to increase attraction of the investigation in photovoltaic system. In order to relate the well known property distributed to the output source through many input sources, by reducing the components and minimums the cost which provide with the maximum power density supply.

Such as to mingle the energy renewable source and storage energy unit the converters which two or three port converters where used. This type of system the mismatching handled of the power system as storage unit is an absorbed as a low load in the converters. However many method of renewable energy has been proposed so as to control the load consumption in increase of source power.

**Author for correspondence*

An ANN controller in photovoltaic power generating system is represented by Figure 1. By using ANN controller to increase the power output of the converter in buck boost with an application of PV system as represented in the Figure 2.

2. Analysis of Proposed System

The current supplied by PV is as follows:

$$i = I_0(1-e^{KV_T})\cdots(1)$$

The inductance of buck boost converter is

$$L = RTK(1-K)^2/2\cdots(2)$$

$$C = K/2fR\cdots(3)$$

The output of inverter is related to input voltage as

$$V_0 = \frac{4V_d}{\pi\sqrt{2}}\cdots(4)$$

The parameters used for simulation are calculated based on the above formulae.

3.Simulation Results

An open loop model with many inputs is shown in Figure 3a. The Figure 3b and 3c represents the increased power as an input source of solar energy and converter in boost model as output1 resource. The alternate current output and loaded energy where represented by the Figure 3d and 3e. To maintain the output resources the photovoltaic system and ANN controller where used.

The system of closed loop with proportional integral controller is represented in Figure 4a. The charging method in the input source of current and resources in the output source of the converter is described in Figure 4b and 4c. The current waveform of the output source is shown in the Figure 4d and 4e.

An ANN controller model in system of closed loop is as in the Figure 5a. The ANN method is applied to maximise the input source and to find the output resources with converter of buck boost where represented by the Figure 5b and 5c. The Figure 5d and 5e represents the output resource voltage. By applying ANN controller the error of settling time with the steady state condition is minimised as 5V to 0.01V.

4. Comparison - Responses with PI and ANN Controllers

By applying the ANN controller in the converter of buck boost as a parallel system arrangement gives an effective result with compared to PI controller. The rise time variable is reduced by 40% and peak time dimension is reduced by 35% in ANN controller as it was 15% and 20%

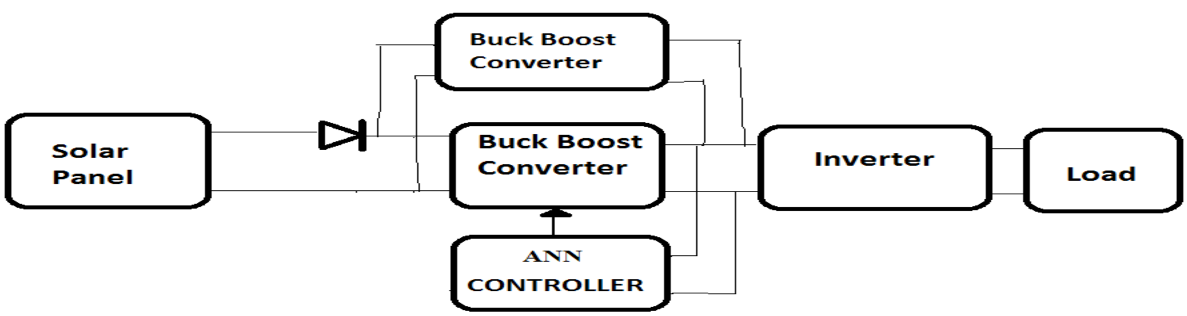

Figure 1. Photovoltaic system Using ANN.

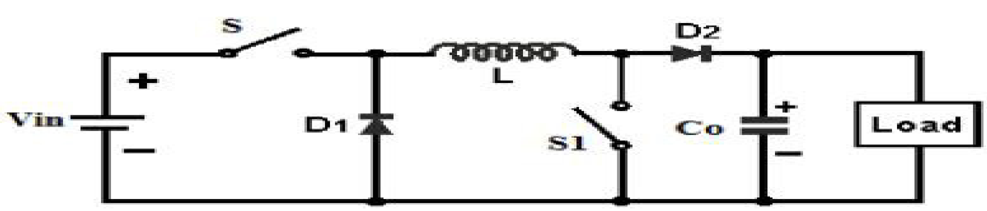

Figure 2. Circuit of two switch buck boost converter.

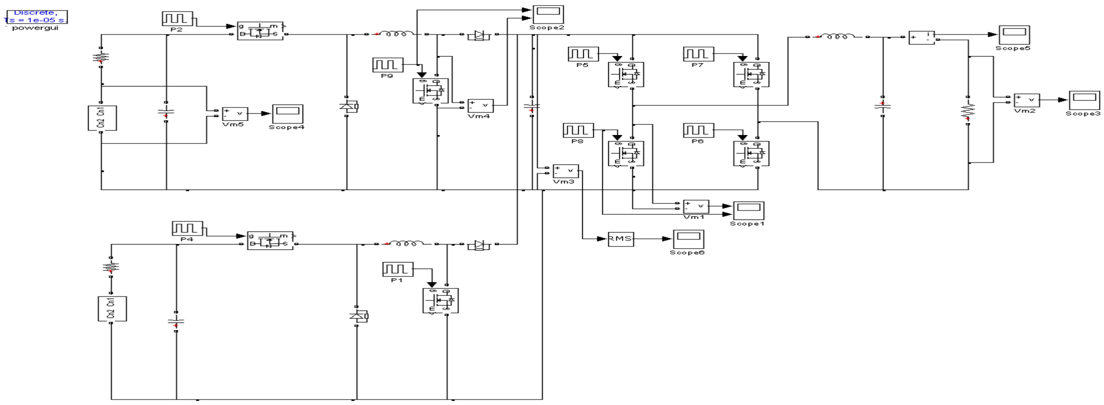

Figure 3a. System of open loop controller with different step of input.

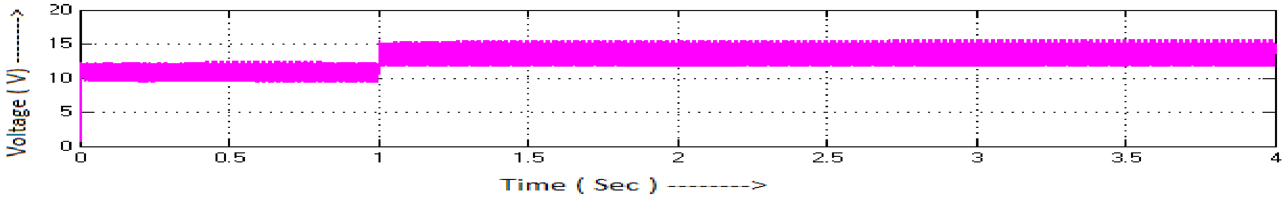

Figure 3b. Solar system with input voltage.

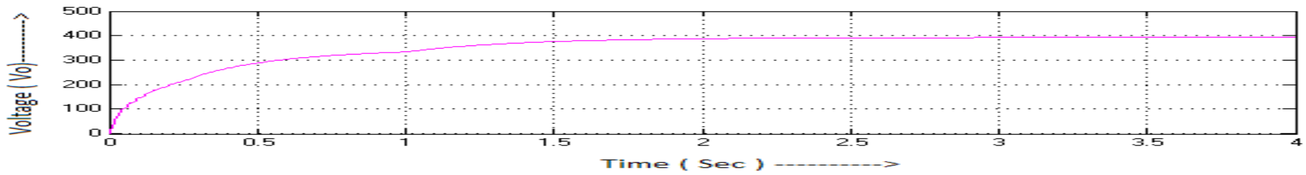

Figure 3c. Buck-boost converter as output voltage.

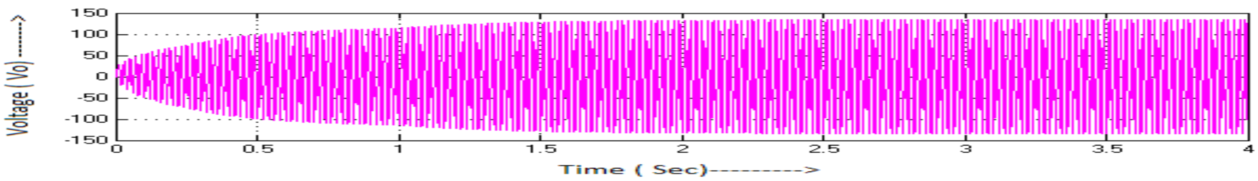

Figure 3d. Output voltage inverter.

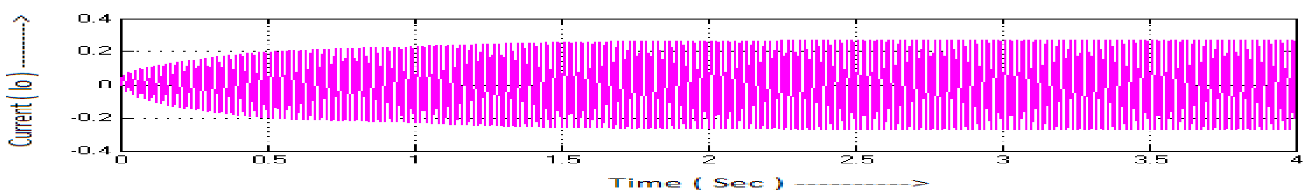

Figure 3e. Output current inverter.

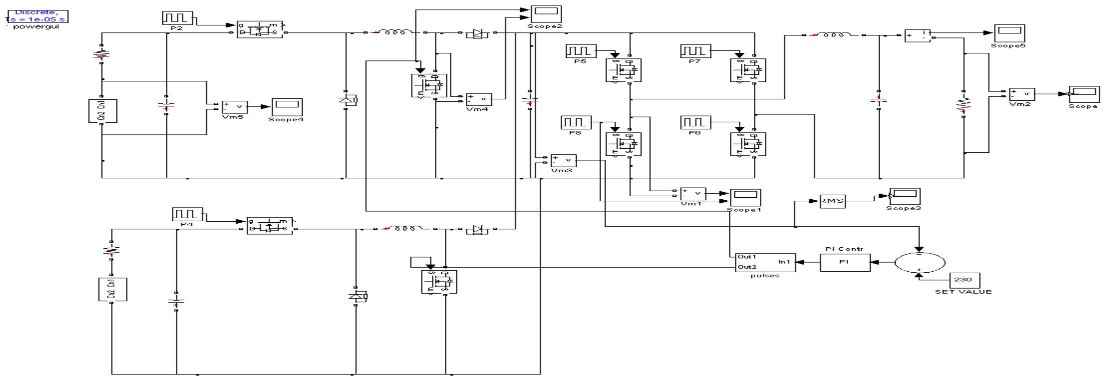

Figure 4a. Closed loop system - PI controller.

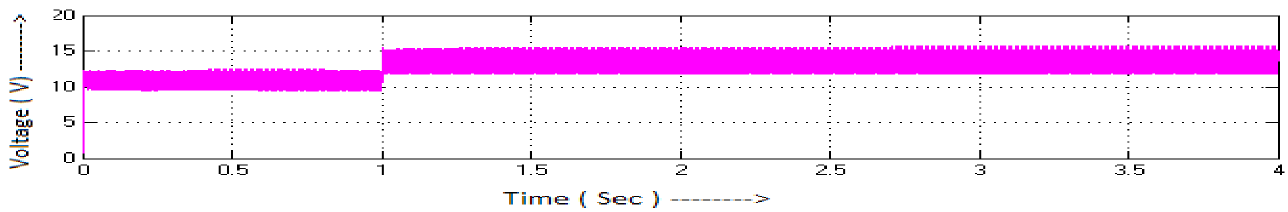

Figure 4b. Input voltage solar system.

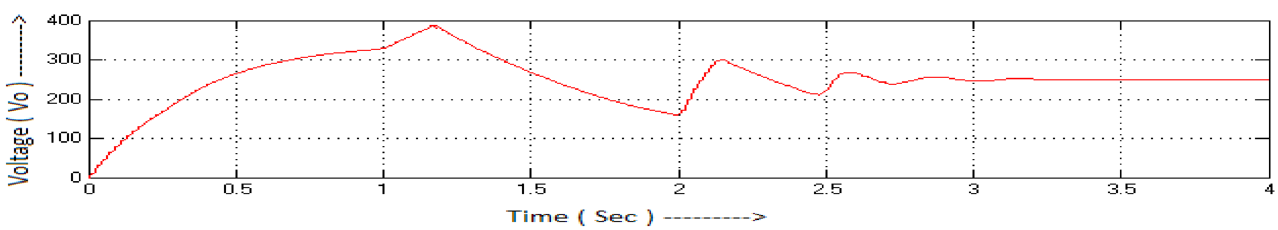

Figure 4c. Output voltage buck -boost converter.

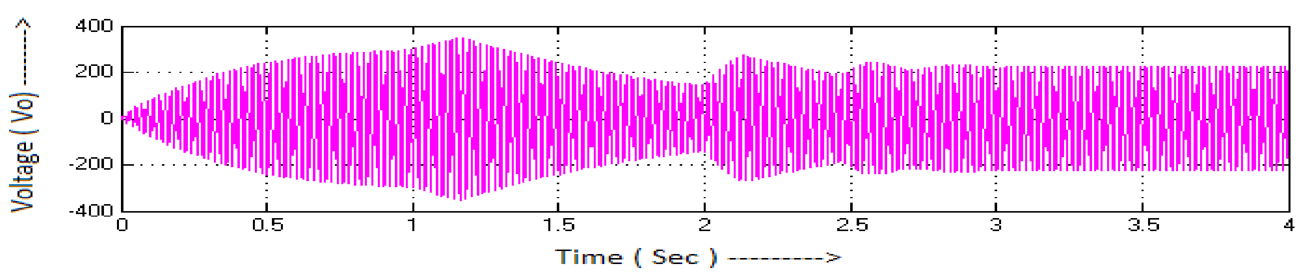

Figure 4d. Output voltage inverter.

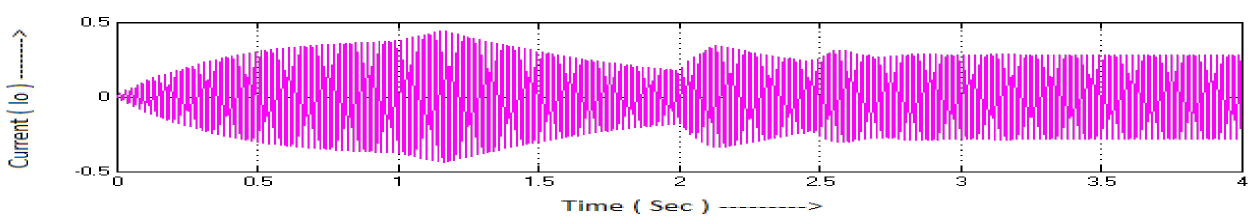

Figure 4e. Output current inverter.

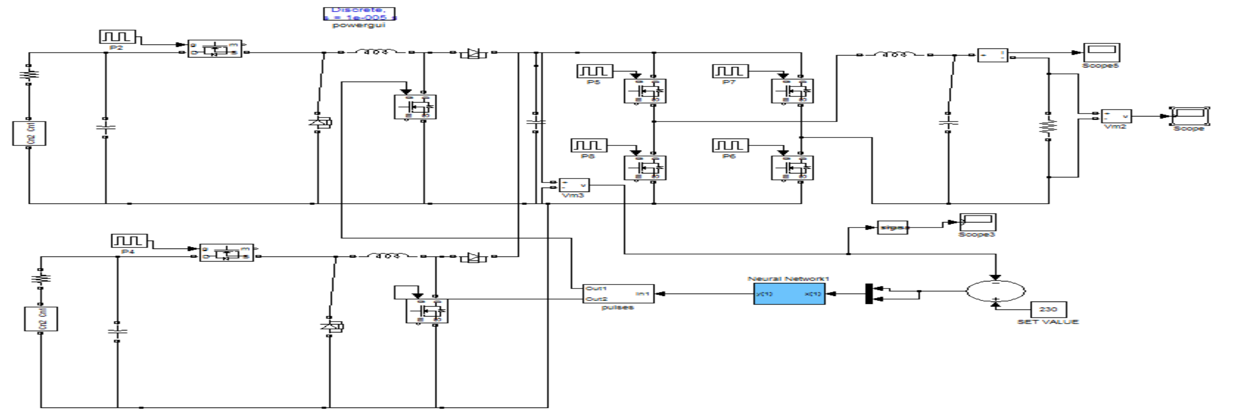

Figure 5a. Closed loop system with ANN.

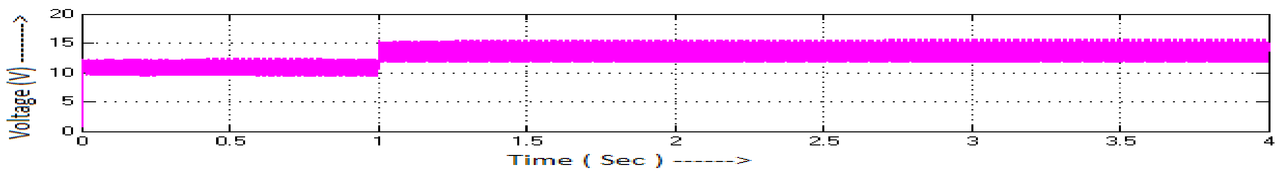

Figure 5b. PV system.

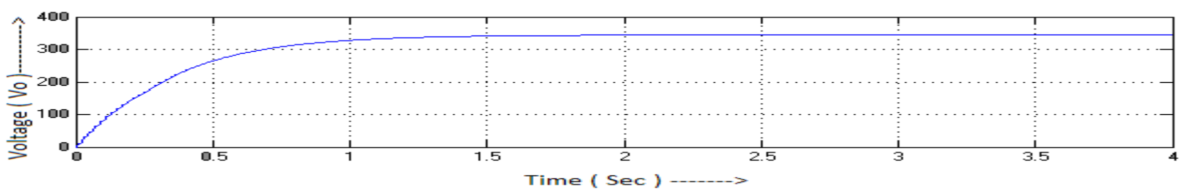

Figure 5c. Converter - Buck boost.

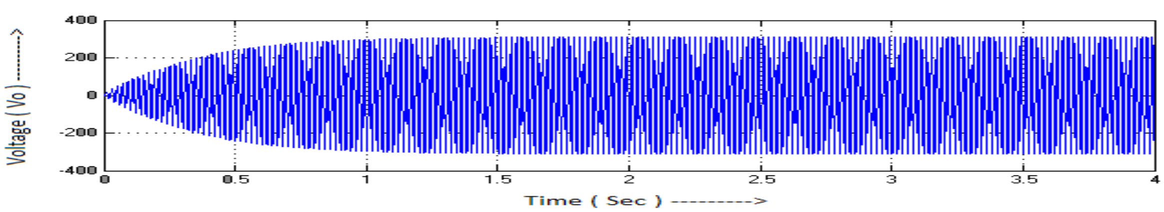

Figure 5d. Inverter voltage.

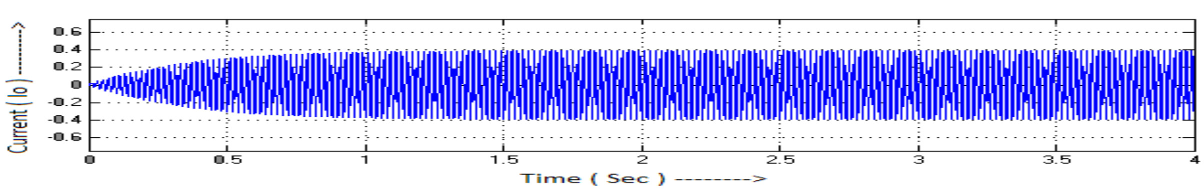

Figure 5e. Inverter current.

in PI controller. By using PI controller the variables settling time and steady state error is achieved by 10% and 5% respectively, where in ANN controller it is as 50% and 90% respectively.

5. Conclusion

This work has reviewed various controllers for improving dynamic response of PV inverter system. The PI and ANN are successfully modelled and simulated using sim power system. By applying ANN controller in closed loop format helps to minimise the steady state error and settling time of the converter in buck boost. The comparison shows that ANN controller gives on effective result for the close loop system as parallel interleaved arrangement. The output waveform in present study of using ANN in a closed loop model inverter system gives on efficient result. The closed loop simulation using GA based controller will be done in future.

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7. References

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