

Integration Issues in Grid Tied Solar PV Systems Solutions Using ANFIS Algorithm & Matlab Simulink

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ABSTRACT:

This project describes and evaluates an Adaptive Neuro-fuzzy Inference System (ANFIS)-based energy management system (EMS) of a grid-connected solar PV system. This PROJECT presents analysis of a grid-connected PV system with Maximum Power Point Tracking (MPPT) control.

A detailed simulation model of system with MPPT control is created. The outcomes acquired from the reenactments point to the more productive utilization of the ANFIS show proposed as a MPPT calculation for PV modules in contrast with other existing techniques..

Keywords: Adaptive Neuro Fuzzy Interference System (ANFIS), Maximum power point tracking (MPPT), Photovoltaic (PV), DC/DC Converters, Three stage inverter.

I. INTRODUCTION:

Renewable energy sources assume a critical job in electrical energy generation. Power frameworks are experiencing generous changes as age moves from huge brought together customary power plants to little decentralized sustainable power plants. Truth be told, the utilization in these little power plants of Integrated Renewable Energy Source frameworks (IRES).

Renewable energy resources (RES) like solar and wind are going to become alternative for future energy needs. India is a nation of mainland size and this is useful in adjusting

The variable yield of sustainable power sources situated in few states by coordinating them into all India lattices. As on August 31, 2018 the grid interactive power generation from RES in the state of Tamil Nadu is 11654MW with 2365.627 MW capacity from solar PV itself. The graph shows variation of solar generation in Million units from inception of solar plants to the present.

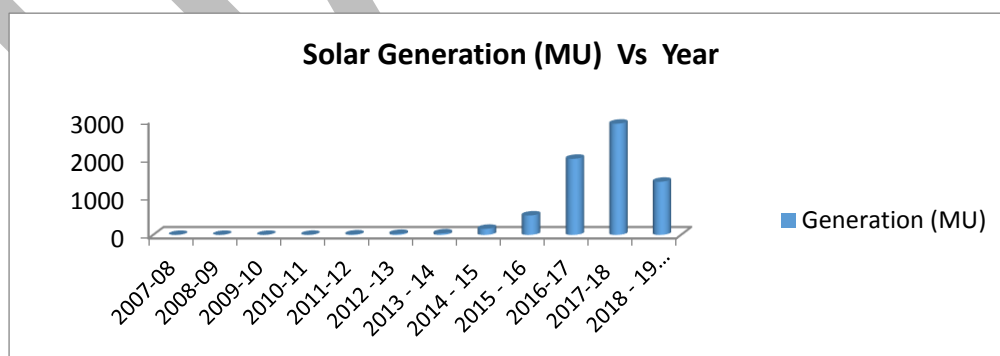


Fig.1. variation of solar generation

The PV module efficiency is low and hence it is desirable to operate the module at the peak power point so that the maximum power can be delivered to the load under varying temperature and insolation conditions. Consequently augmentation of intensity enhances the usage of the sun based PV module. A maximum power point tracker (MPPT) is used for extracting the maximum power from the solar pv

module and transferring that power to the load. A dc/dc converter (step up/step down) serves the purpose of transferring maximum power from the solar PV module to the load. Maximum power point tracking is used to ensure that the panel output is always achieved at the maximum power point.

Fuzzy logic controller and artificial neural networks are two principle AI techniques utilized for MPPT. In this paper, planning and execution of ANFIS based MPPT conspire which is interfaced with open circle support converter is displayed. ANFIS joins the benefits of neural networks and fuzzy logic and hence deals efficiently.

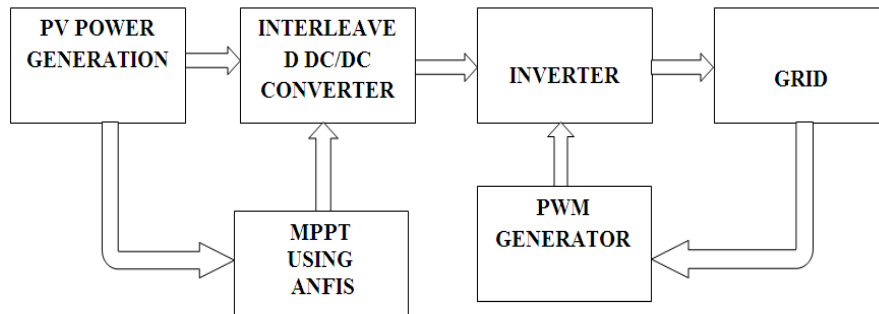


Fig.2. Block Diagram of Proposed System

II. DESIGN IMPLEMENTATION OF PROPOSED SYSTEM

The block schematic of the MPPT is constituted of solar PV module, DC-DC boost converter, proportional integral (PI) controller, PWM signal generator and ANFIS reference model. Irradiance level and operative temperature are taken because the input for the ANFIS reference model. The ANFIS reference model provides out the crisp price of most obtainable power from the PV module at a selected temperature and irradiance level. The actual output power from the PV module, at same temperature and irradiance level, is calculated by using multiplication algorithm on sensed operating voltage and currents. Two powers are compared and also the error is given to a proportional integral (PI) controller, to get management signals. The control signal generated by PI controller is given to the PWM generator. The generated PWM signals management the duty cycle of DC-DC boost device, so as to regulate the operative purpose of the PV module.

A. ANFIS FUZZY INTERFACE SYSTEM

ANFIS may be a Sugeno network among the accommodative systems facilitating learning and coaching. That framework makes models a lot of systematic associated uses knowledgeable data so user doesn't need to be a knowledgeable.

An Adaptive Neuro-fuzzy Inference System or Adaptive Network-based Fuzzy Inference System (ANFIS) is a kind of artificial neural network that is based on Takagi–Sugeno fuzzy inference system. Since it integrates each neural networks and symbolic logic principles, it's potential to capture the advantages of each in a very single framework. Its illation system corresponds to a collection of fuzzy IF – THEN rules that have learning capability to approximate nonlinear functions.

Hence, ANFIS is taken into account to be a universal reckoner. For exploitation the ANFIS in a very a lot of economical and best method, one will use the simplest parameters obtained by genetic rule.

The ANFIS reference model offers out the crisp price of most accessible power from the PV module at a particular temperature and irradiance level. The actual output power from the PV module, at same temperature and irradiance level, is calculated by using multiplication algorithm on sensed operating voltage and currents.

ANFIS generates the set of fuzzy rules so as to provide acceptable output for various values of inputs. Parameters of membership functions area unit adjusted or modified until the error is reduced to minimum price. Once all the parameters of membership operate area unit adjusted, the ANFIS model becomes learning model that is prepared to be employed in MPPT management theme software.

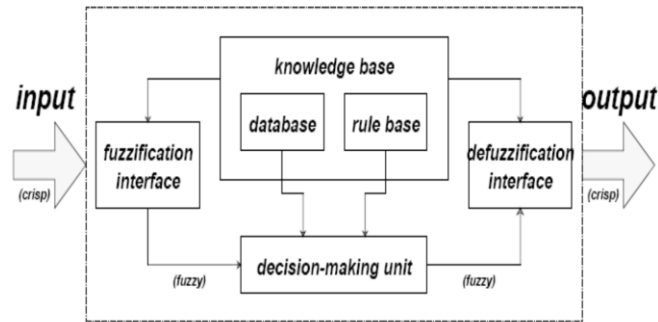


Fig.3. Block of ANFIZ FUZZY SYSTEM

The simulation model of the system is as shown in the figure 3.

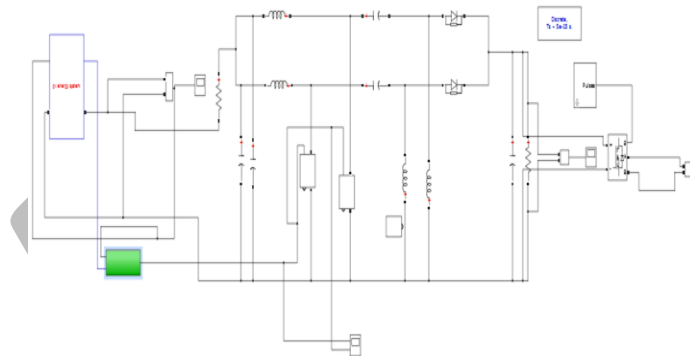


Fig.4.Simulation diagram of proposed system

The system consists of PV solar system is also simulated and designed. The simulation model of solar PV system is as shown in the figure 4.

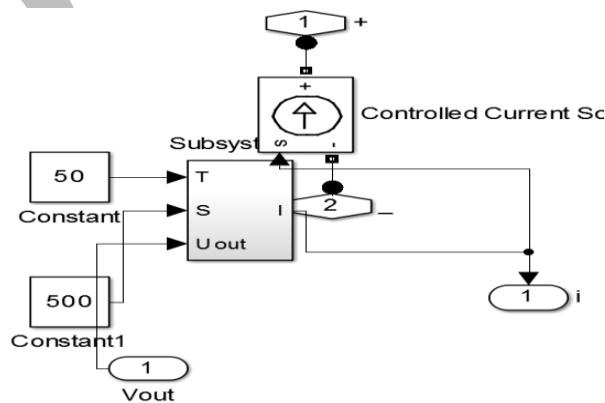


Fig.5.simulation model of solar PV system

The proposed MPPT algorithm consists of hybrid technique called as ANFIS algorithm. The mppt algorithm is as shown in the figure 5.

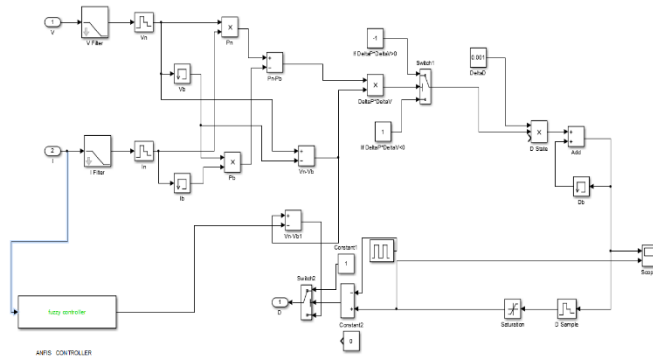


Fig.6.Simulation model of proposed MPPT Technique

The implemented algorithm is as shown in the figure 6.

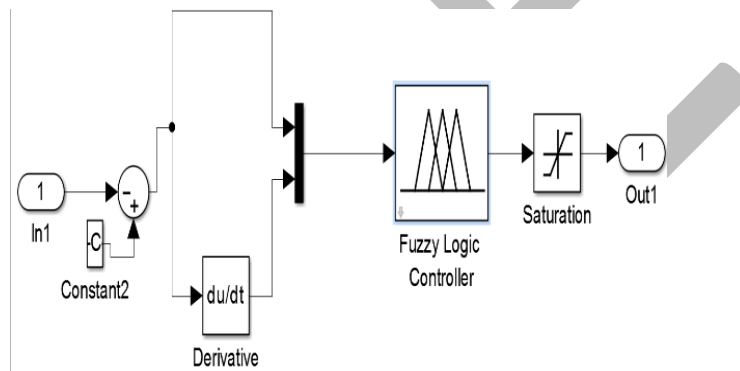


Fig.7.ANFIS algorithm implemented MPPT technique Simulation model.

The interleaved boost converter is used to convert DC to DC high output voltage is as shown in modelled as shown in the figure 7.

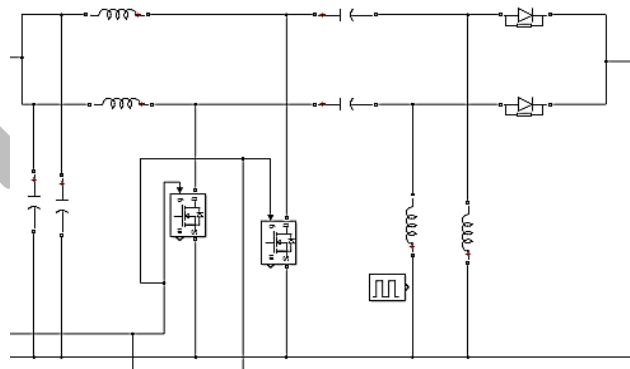


Fig.8.Interleaved Boost converter Simulation Model

III.Simulation Output and Results

The proposed system is successfully simulated using MATLAB/Simulink simulation software. The proposed system PV output voltage is as shown in the figure 8.

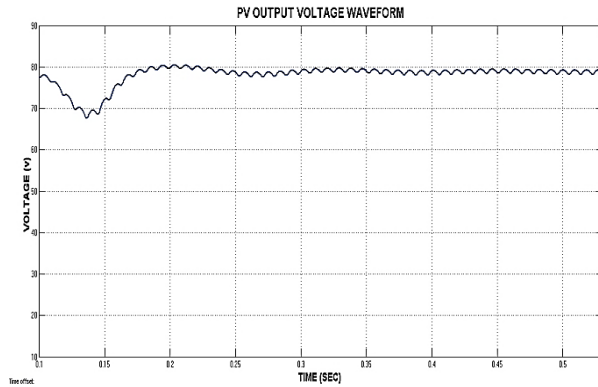


Fig.9.PV output Voltage waveform

The proposed system generated the above voltage of about 80 voltage DC output from Solar PV panel. The DC voltage is boosted through interleaved boost converter the output voltage waveform is as shown in the figure 9.

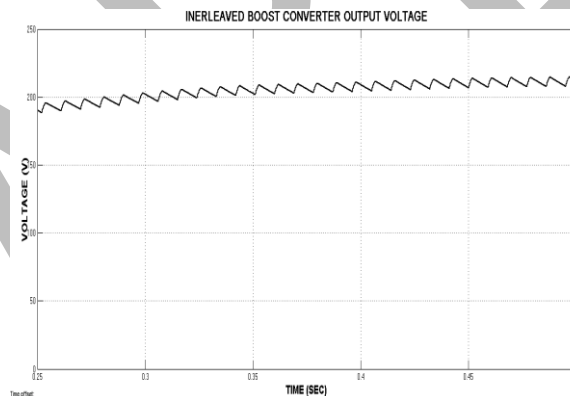


Fig.10.Interleaved Boost converter output voltage waveform

The MPPT algorithm proposed is as shown in the figure 10. The waveform generated by ANFIS algorithm.

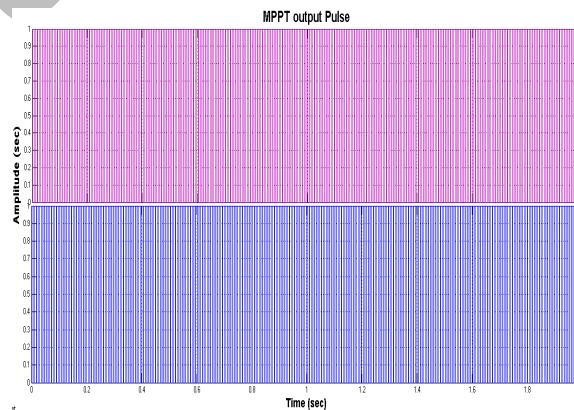


Fig.11.MPPT algorithm of Proposed ANFIS algorithm output waveform

The boost converter output is fed into the inverter circuit is then converted into AC power. The AC Voltage power is as shown in the figure 11.

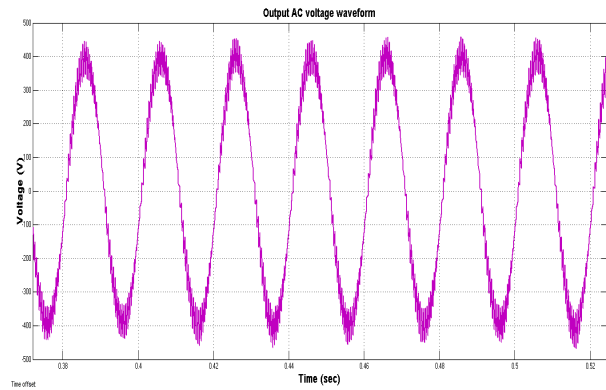


Fig.12.AC output voltage waveform

This purposed system is compared with the existing P and O algorithm. The p and O MPPT algorithm output pulse generation for interleaved boost converter is as shown in the figure 12.

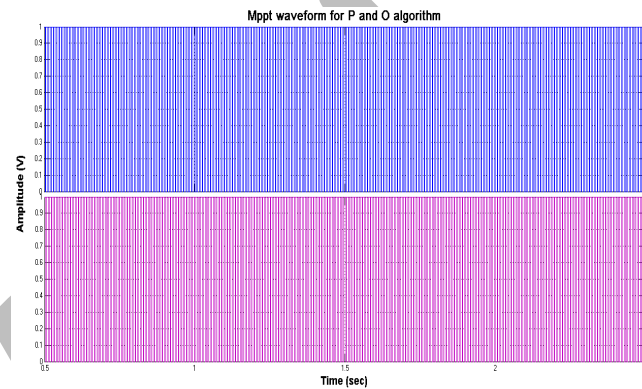


Fig.13.MPPT algorithm output pulse generation of P and O algorithm

Through this output pulse the boosted voltage is very less than the proposed system. The output AC voltage waveform of existing P and o algorithm is as shown in the figure 13.

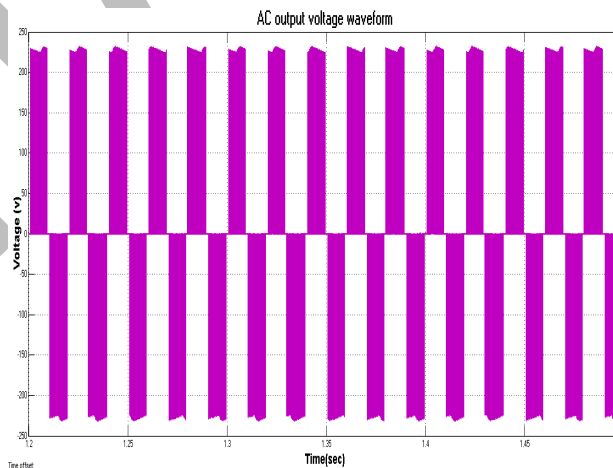


Fig14.AC output voltage waveform of existing system.

From the waveforms generated from this section the conclusions are made in the next section.

IV. Conclusion

A new method called ANFIS is proposed for efficient solar PV system conversion for connecting it to either load or grid. The proposed algorithm is compared with the existing P and O algorithm for the difference in voltage output observation.

This project work proves that ANFIS as a method meets the requirements of a PV system to use the MPPT algorithm. It should be underlined that the benefits of ANFIS as an MPPT method are multiple and the results obtained from the simulations point to the more efficient usage of the ANFIS model compared to others.

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