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An Innovative Technique for Controlling of Output Power in PV System: A Technological Review

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ABSTRACT: Renewable energy resources play an important role in electric power generation. There are various renewable resources which is used for electric power generation, such as solar energy, wind energy, geothermal etc. Solar Energy is a good choice for electric power generation, since the solar energy is directly converted into electrical energy by solar photovoltaic modules. When many PV modules are connected in series and parallel combinations we get a solar PV array, which is suitable for obtaining higher power output. There are two major approaches for maximizing power extraction in solar systems. They are sun tracking, maximum power point (MPP) tracking or both. Later on in this review, we discuss about two MPP tracking techniques are studied and compared. The technique is based on feed forward neural networks and the second one is based on the incremental conductance method. The FFNN method gave very fast and accurate response for power output.

KEYWORDS: PV Array, Arificial Intelligence Methods, 3-level bridge Inverter, Feed forward neural network.

I.INTRODUCTION

Renewable resources such as the solar wind etc offers clean, abundant energy .As the power demand increases power failure also increases so the renewable energy can be used to provide constant loads. To converting the basic circuit equation of solar cell into simplified form a model developed including the effects of changing solar irradiation and temperature. This paper consists of solar array and grid interface inverter. Power control strategy is used to extract the maximum power. Maximum power point tracker (MPPT) control is essential to ensure the output of photovoltaic power generation system at the maximum power output as possible. There are many MPPT technique. In this paper incremental conductance (IncCond) method is used and simulated in Matlab/Simulink. IncCond method has more precise control and faster response, but it has higher hardware requirement. in order to achieve maximum efficiency of photovoltaic power generation, an efficient control methods that is IC should be chosen. The voltage source inverter interface with grid transfers the energy drawn from the PV array to the grid by keeping common dc voltage constant. The simulation results show the control performance and dynamic behavior of the PV system using feed forward neural network.

The basic objective of this paper is to extract maximum power and to maintain power quality to a satisfactory level from the varying condition of the Photovoltaic array with different solar irradiation. To capture the maximum power from the PV system, maximum power point tracking is applied.

II. MODELING OF SOLAR CELL

PV array are formed by combine no of solar cell in series and in parallel. A simple solar cell equivalent circuit model is shown in figure. To enhance the performance or rating no of cell are combine. Solar cell are connected in series to provide greater output voltage and combined in parallel to increase the current. Hence a particular PV array is the combination of several PV module connected in series and parallel. A module is the combination of no of solar cells

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connected in series and parallel. the result shows the nonlinear characteristics of photovoltaic array at different irradiations and temperature.

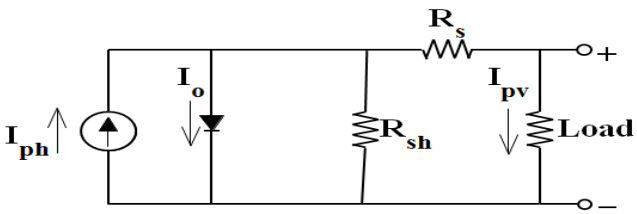

Fig 2: Circuit diagram of a single PV Cell.

III.ARTIFICIAL INTELLIGENCE METHODS

There are two main AI methods, Fuzzy logic based MPPT and Neural Networks based ones.

Both ANFIS and FFNN methods has their advantages and drawbacks. ANFIS methods are famous for their easy implementation and compatibility to operate with any Photovoltaic array, While they're disadvantages is that they are considered relatively slower than the FFNN methods and not only that they show slow response in sudden temperature and solar irradiance changes, but also they may fail in tracking the maximum power point.

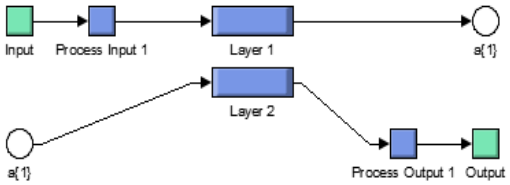

Fig 3: Model of Feed Forward Neural Network.

On the other hand, artificial intelligence methods show very fast response under any operating condition changes, give very accurate results and they are able to work under instant temperature or solar irradiance changes efficiently. The drawbacks of the AI methods that they are complicated in design, they need very fast processors to be implemented physically or otherwise they will run very slowly. For each PV array type, a separate model should be designed to guarantee that it will perform well which is considered also a disadvantage.

IV.MODELING OF 3-LEVEL BRIDGE INVERTER

In distribution power generation system three phase VSI are used to interfere between DC & AC system. For the control of active and reactive power along with constant DC link voltage different control technique are used to the three phase grid connected voltage source Inverter. Now a days power electronics converter are widely employed in all the application due to the switches non linearity occur in the system so the power stage must be linearised.

V. MPPT USING FEED FORWARD NEURAL NETWORK

MPPT or Maximum Power Point Tracking is algorithm that included in charge controllers used for extracting maximum available power from PV module under certain conditions. The voltage at which PV module can produce maximum power is called 'maximum power point' (or peak power voltage). Maximum power varies with solar radiation, ambient temperature and solar cell temperature.

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Feed Forward Neural Network (FFNN) is an artificial network that mimics the human biological neural networks behavior, widely used in modeling complex relationships between inputs and outputs in nonlinear systems. FFNN can be defined as parallel distributed information processing structure consisting of inputs, and at least one hidden layer and one output layer. These layers have processing elements called neurons interconnected together.

VI.CONCLUSION

Due to the importance of photovoltaic systems, this paper presents a study of maximum power point tracking using artificial neural network. This paper summarizes the main points presented in this work with suggested future research on the proposed method of maximum power point tracking. It has presented a literature review on the famous renewable energy resources and then highlighted the photovoltaic energy . An FFNN with maximum power point tracking technique using neural networks is proposed, which predicts maximum power can be obtained from the PV system. The conventional incremental conductance MPPT algorithm is developed through MATLAB code . FFNN neural network MPPT method under sudden temperature and irradiance changes gave very fast and accurate response

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