

# A Review Paper On the Performance of PV System to Get Maximum Energy under Different Environmental Condition

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## ABSTRACT

Solar PV technology has emerged as one of the most matured and fast evolving renewable energy technologies and it is expected that it will play a major role in the future global electricity generation mix. Keeping the rapid development of the PV technology into consideration, this chapter systematically documents the evolution of solar PV material as well as the PV applications and PV markets. It also provides insight into the trend in batteries and inverters used for solar Applications. Furthermore, a comparative analysis of different PV technologies and its development is summarized. The rest of the chapter aims at providing a comprehensive analysis of solar radiation measurement and modelling techniques to assess the availability of solar radiation at different locations. The chapter presents comprehensive information for solar energy engineers, architects and other practitioners.

**Keywords-** Photovoltaic, Matlab/Simulink, Environmental Conditions

## I INTRODUCTION

Due to the depletion of non-renewable sources of energy and increase in demand for electricity man has to search for alternative sources like renewable energy sources. Solar energy is one such renewable sources of energy which works on the principle of photovoltaic effect[1]. Solar cell is the main element which converts solar energy into electrical energy. Solar cells are connected in series or parallel depending on requirement to form solar module[2]. Solar modules are again connected in series or parallel depending on the current and voltage requirement to form solar array[3-4]. Solar cell provides clean and pollution free energy unlike traditional source of energy like coal, diesel, natural gas, nuclear energy. Photovoltaics (PV) is a term which covers the conversion of light into electricity using

semiconducting materials that exhibit the photovoltaic effect, a phenomenon studied in physics, photochemistry, and electrochemistry[5-6]. A typical photovoltaic system employs solar panels, each comprising a number of solar cells, which generate electrical power[7]. PV installations may be ground-mounted, rooftop mounted or wall mounted. The mount may be fixed, or use a solar tracker to follow the sun across the sky.

Solar PV has specific advantages as an energy source: once installed, its operation generates no pollution and no greenhouse gas emissions, it shows simple scalability in respect of power needs and silicon has large availability in the Earth's crust

## II LITERATURE REVIEW

NURUL AFIQAH ZAINAL et.al In the year 2016 published a paper on IOP state that Photovoltaic (PV) module consists of numbers of photovoltaic cells that are connected in series and parallel used to generate electricity from solar energy. The characteristics of PV module are different based on the model and environment factors. In this paper, simulation of photovoltaic module using Matlab Simulink approach is presented. The method is used to determine the characteristics of PV module in various conditions especially in different level of irradiations and temperature. By having different values of irradiations and temperature, the results showed the output power, voltage and current of PV module can be determined. In addition, all results from Matlab Simulink are verified with theoretical calculation. This proposed model helps in better understanding of PV module characteristics in various environment conditions. [1]

Xuan Hieu Nguyen et.al In the year 2015 published a paper in environmental system research Photovoltaic (PV) array which is composed of modules is considered as the

fundamental power conversion unit of a PV generator system. The PV array has nonlinear characteristics and it is quite expensive and takes much time to get the operating curves of PV array under varying operating conditions. In order to overcome these obstacles, common and simple models of solar panel have been developed and integrated to many engineering software including Matlab/Simulink. However, these models are not adequate for application involving hybrid energy system since they need a flexible tuning of some parameters in the system and not easily understandable for readers to use by themselves. Therefore, this paper presents a step-by-step procedure for the simulation of PV cells/modules/ arrays with Tag tools in Matlab/Simulink. A DS-100M solar panel is used as reference model. The operation characteristics of PV array are also investigated at a wide range of operating conditions and physical parameters. [2]

HABBATI BELLIA et.al In the year 2014 published a paper on NRIAG state that the PV module is the interface which converts light into electricity. Modelling this device, necessarily requires taking weather data (irradiance and temperature) as input variables. The output can be current, voltage, power or other. However, trace the characteristics  $I(V)$  or  $P(V)$  needs of these three variables. Any change in the entries immediately implies changes in outputs. That is why, it is important to use an accurate model for the PV module. This paper presents a detailed modelling of the effect of irradiance and temperature on the parameters of the PV module. The chosen model is the single diode model with both series and parallel resistors for greater accuracy. The detailed modelling is then simulated step by step using MATLAB/Simulink software due to its frequent use and its effectiveness.[3]

R.AYAZ et.al In the year 2014 published a paper on IJP state that A photovoltaic (PV) model is proposed on Matlab/Simulink environment considering the real atmospheric conditions and this PV model is tested with different PV panels technologies (monocrystalline silicon, polycrystalline silicon, and thin film). The meteorological data of Istanbul—the location of the study—such as irradiance, cell temperature, and wind speed are taken into account in the proposed model for each technology. Eventually, the power outputs of the PV module under real

atmospheric conditions are measured for resistive loading and these powers are compared with the results of proposed PV model. As a result of the comparison, it is shown that the proposed model is more compatible for monocrystalline silicon and thin-film modules; however, it does not show a good correlation with polycrystalline silicon PV module. [4]

Kamal Keshavani et.al In the year 2014 published a paper on IJEDR state that Photovoltaic power supplied to the utility grid is gaining more and more visibility while the world's powers demand increases. In this paper we are defining a circuit based simulation model for a PV cell in order to estimate the electrical behavior of the cell with respect to changes in environmental parameters such as temperature and irradiance. The PV system requires many special design considerations due to varying nature of the solar power generated resulting from unpredictable and sudden changes in weather conditions which change the solar irradiation level as well as the cell operating temperature of PV arrays. PV cell is the most basic element of photovoltaic generation units, which converts the solar energy into electrical energy. This paper focuses on a MATLAB/Simulink model of a photovoltaic cell. This model is based on mathematical equations and is described through an equivalent circuit including a photocurrent source, a diode and a series resistor. The developed model allows the prediction of PV cell behaviour under different physical and environmental parameters. In addition, this paper outlines the working principle of PV module as well as PV array. So this completed model accepts irradiance and temperature as variable parameters and outputs the I-V as well as P-V characteristic. In order to validate the developed model, the simulation results are compared with the standard results and characteristic curves provided by the PV array manufacturer and they show excellent resemblance. [5]

SHIVANANDA PUKHREM et.al In the year 2013 published a paper on IJSRT state that A circuit based simulation model for a PV cell for estimating the  $IV$  characteristic curves of photovoltaic panel with respect to changes on environmental parameters (temperature and irradiance) and cell parameters (parasitic resistance and ideality factor). This paper could be used to analyse in the development of *MPPT* (maximum power point tracking)

algorithm. Using a Shockley diode equation, an accurate Simulink PV panel model is developed. [6]

AARTI KANE et.al In the year 2013 published a paper on ICPEC state that the objective of this paper is to develop mathematical model of Photovoltaic (PV) module and study effects of environmental factors on its performance. Output of PV module strongly depends on environmental conditions like solar irradiance, ambient temperature and wind speed etc. Mathematical model is developed in Matlab/Simulink environment by considering effect of above conditions. Maximum power point voltage and PV module temperature relationship is determined utilizing simulated results. An attempt has been done to develop Maximum power point tracking (MPPT) algorithm based on cell temperature and solar irradiance to improve the efficiency of PV power generation system. [7]

KRISMADINATA et.al In the year 2012 published a paper on Elsevier state that paper describes a method of modelling and simulation photovoltaic (PV) module that implemented in Simulink/Matlab.. The simulation results are compared with difference types of PV module datasheets. Its results indicated that the created simulation blocks in Simulink/matlab are similar to actual PV modules, compatible to different types of PV module and user-friendly. [8]

J.A. RAMOS-HERNANZ et.al In the year 2012 published a paper on IJTPE states that the study of photovoltaic systems in an efficient manner requires a precise knowledge of the *IV* and *PV* characteristic curves of photovoltaic modules. Therefore, the objective of this paper is to develop two different computer models to simulate the behavior of a photovoltaic cell, to be able to represent these *IV* and *PV* curves. Both models are implemented in Matlab- Simulink. These two models are part of a larger study of different ways to simulate a cell or photovoltaic panel presented in section two. To demonstrate the validity of the models graphs *IV* and *PV* curves resulting with those provided by the manufacturer have been compared. To analyze the operation and the suitability of the model it is necessary to have precise knowledge of these curves. [9]

SABIR RUSTEMLI et.al In the year 2012 published a paper on PEZT state that the early days of photovoltaic panels, some 50 years ago, the energy required to generate a photovoltaic panel was more than the energy the panel could generate during its lifetime.. Also, environmental factors is added to the model and is entered the system. In addition to this situation were applied on loaded. With this modelling the effects of environmental factors for photovoltaic panels are designed and discussed as detailed by Matlab/Simulink programme. [10]

### III PROPOSED METHDOLOGY

#### PV PANEL BLOCK DIAGRAM

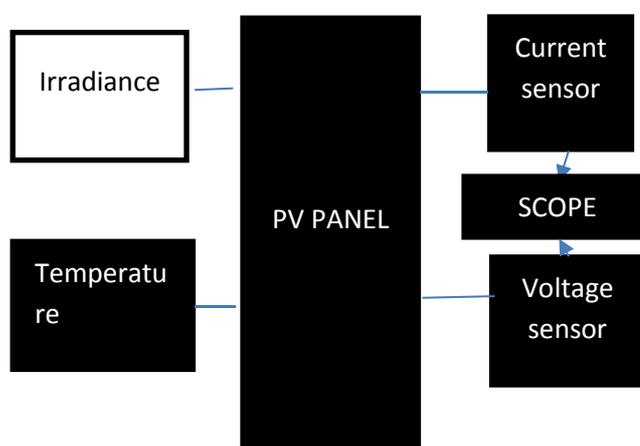


Figure 4.4 BLOCK DIAGRAM OF PV PANEL MODEL

### IV CONCLUSION

The study will provide an insight to identify the behavior of PV panel with change of the environmental parameters like temperature and irradiance and cell parameters parasitic resistance and ideality factor and also to estimating the *IV* curves under such changes. Considering the environmental and cell parameters, a PV cell simulation set up model based on PV cell equations is developed in MATLAB/SIMLINK with a variable load resistance at the output.

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