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STUDY THE OPERATIONAL BEHAVIOR OF PV GENERATOR WITH ENVIRONMENTAL CONDITION

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Abstract:
The combination of series and parallel connected PV modules made Photovoltaic (PV) generator. In this PV generator the level of current is increased by parallel connection and voltage level is increased by series connection. In grid connected applications high level of voltage is require for synchronizing the system with connected PV generator. PV generator operation gives harmful effects due to partial shading. The series connection is more prone to these effects than a parallel connection. In this thesis simulation model of PV generator is made by using MATLAB Simulink software and different configuration analysis can be taken out.

Keywords:
Solar Energy, PV Generator, Renewable Energy, Environmental Effect on Solar Power.

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1. INTRODUCTION

In area of distributed generation interest in renewable energy resources has caused the photo-voltaic (PV) power market to expand rapidly. Due to this reason, designers need a flexible and reliable tool to accurately predict the electrical power produced from PV arrays of various sizes. The semiconductor device that converts sunlight into electricity called cell. Most of the mathematical models developed are based on current-voltage relationships that result from simplifications to the double-diode model proposed by Chan & Phang (1987). The current-voltage relationship for the single-diode model assumes that one lumped diode mechanism is enough to describe the characteristics of the PV cell. This current-voltage relationship is the basis for the mathematical models developed by Desoto et al. (2006) and Jain & Kapoor (2004)**.**

In present days the demand power is much more than the production of power. It is typical task to fulfill need without affecting the environment. This raising demand is responsible to development in field of renewable energy sector. At the oil crisis, it becomes clear that the

mankind is dependent on oil. The consumable energy sources are also responsible to change in climate and increase rate of carbon dioxide gas.

As the people aware towards reserve of fossil fuel increased interest in the development of renewable energy technology.

In the non-conventional energy, mainly wind energy and solar energy are considered. Solar energy can be utilized in dual mode, either in thermal or electrical energy. Direct conversion of solar energy to electrical energy is the latest technique to produce electricity as it is pollution free and needs less maintenance. The solar energy is directly converted into electrical energy by using PV cell or generator. The installation cost is very high and efficiency of conversion is low.

Solar energy is one of the best ways to combat climate change and secure the production of energy. The first functional PV cell was made in the late 19th century; still only very small portion of world's electricity consumption is produced by PV systems [2]. Reason for this is that PV generators are not yet economically profitable without supports, because of high investment costs and low power density. However, the photovoltaic market has grown very fast in past years. In 2011, almost 30 GW of new PV capacity was installed. Global PV capacity at the end of 2011 was about 10 times higher than just five years earlier at the end of 2006. Thus, the average annual growth rate exceeded 58 % for this period. [3]

Condition when the different cell or modules of the array are exposed to different irradiance level due to shading known as partial shading.

If a series connection is partially shaded, the module that receives the lowest irradiance level limits the total current of the series connection. When the current of the series connection is larger than the short-circuit current of that module, part of the power produced by other modules is dissipated to heat in that module. This can lead to damaging of that module. These problems can be avoided by using anti-parallel-connected bypass diodes that bypass the portion of the current which exceeds the short-circuit current of the shaded module [4].

A PV generator model based and present by Villalva et al is implemented by using the MATLAB Simulink. To consider shading effect, a shading model is also used.

The simulations include three movement directions of shadows: perpendicular to the strings of a PV generator array, parallel to the strings of the array and diagonal to the array. The aim of the simulations is to study how the configuration of a PV generator, the size of the PV generator array, the movement direction of a shadow and the sharpness of the shadow affect the energy yield of the PV generator.

The main energy source of the photovoltaic systems is sun. Thus, it is important to understand the basics of the Sun and solar radiation in order to understand the operation of photovoltaic systems.

Solar cell is basically a p-n junction fabricated in a thin wafer or layer of semiconductor. Being exposed to the sunlight, photons with energy greater than the band-gap energy of the

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semiconductor are absorbed and create some electron-hole pairs proportional to the incident irradiation. Thus behavior of the PV generator directly depends on insolation and temperature.

RADIATION OF SOLAR AT THE EARTH'S SURFACE

All the activities on earth starts from solar radiation, life cycle is also dependent on it.
The sun is like a nuclear bomb, it originated from nuclear fusion reaction. The Sun is an average size star; its radius is about 6.960·108 m. The mean distance between the Earth and the Sun, known as the astronomical unit, is about 1.496·1011 m [6].

APPARENT MOTION OF THE SUN

At particular location on earth to evaluate the performance of a PV system the apparent motion is a major concern. The Earth revolves around the Sun in an elliptical orbit with the Sun in one of the foci [7]. This orbit is very close to a circle; the maximum deviation of mean distance is less than two per cent [6]. The maximum of this angle ±23.45°, the inclination of the Earth's axis, occurs at the solstices around June 22nd and December 22nd [8].

PHOTOVOLTAIC CELLS

A photovoltaic cell is a device that converts the energy of solar radiation directly into electrical energy. The operation of most of the photovoltaic cells is based on a p-n junction albeit there are also photovoltaic cells that do not contain a p-n junction like desensitized solar cells (DSSC) [9].

2. METHODOLOGY

The model of a photovoltaic generator is implemented by using the MATLAB Simulink software. The model is composed of series and parallel connected photovoltaic modules protected by antiparallel-connected bypass diodes. The model is designed to simulate effects of the temperature and the irradiance on the operation of photovoltaic generators.

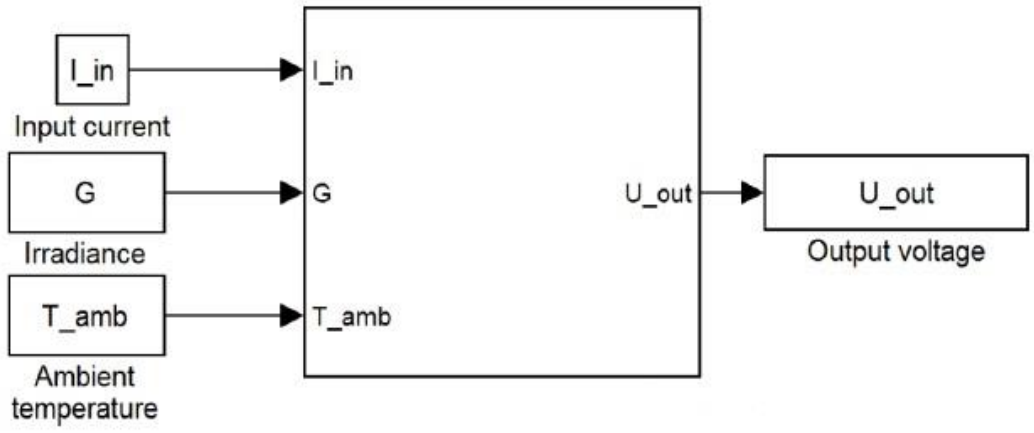

Figure 1: Simulink model of a photovoltaic module with a bypass diode in parallel

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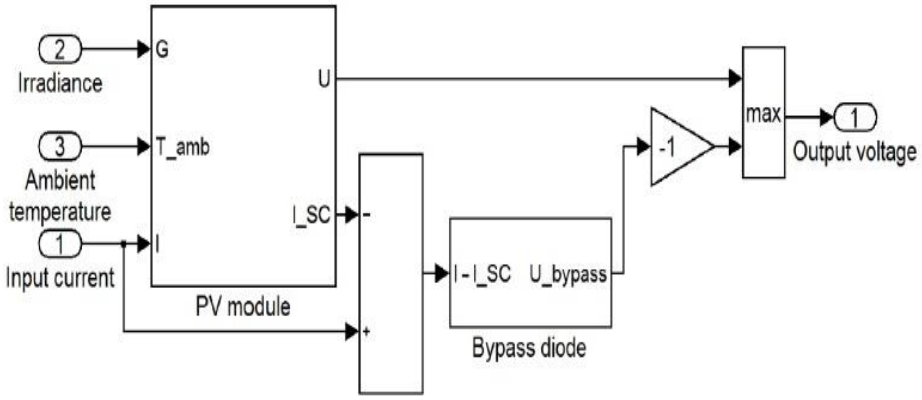

Figure 2: Simulink model of a photovoltaic module and bypass diode

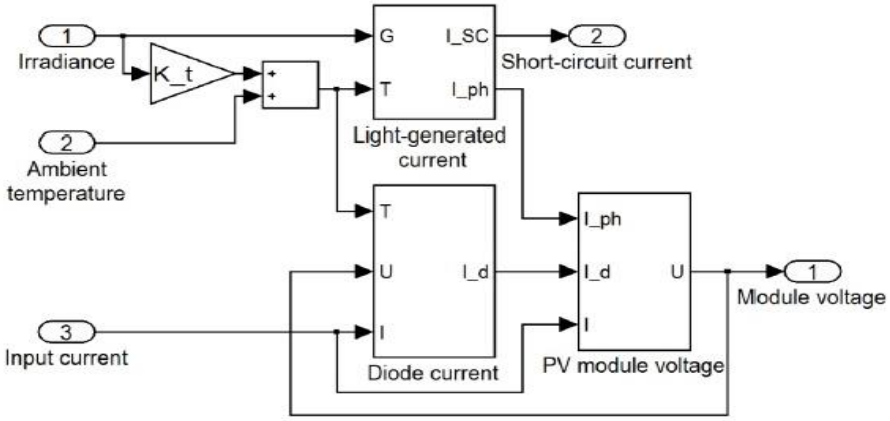

Figure 3: Simulink model of a photovoltaic module

3. RESULTS

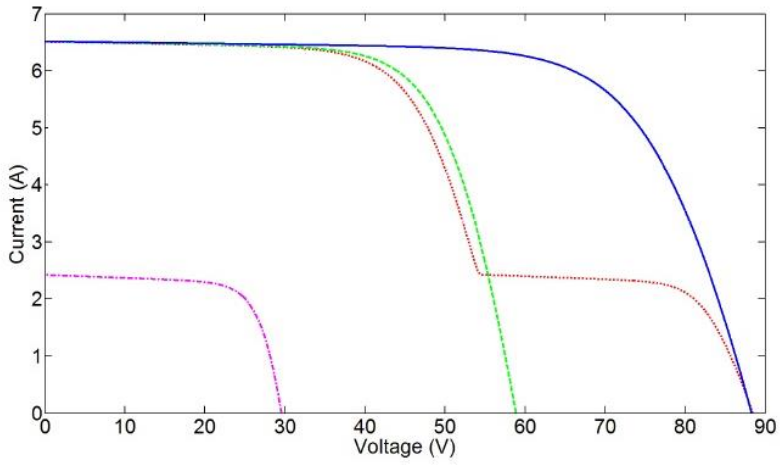

Figure 4: The I-V curves of the string of three unshaded modules, the string of two unshaded modules, the string of two unshaded and one shaded modules and the I-V curve of one shaded module.

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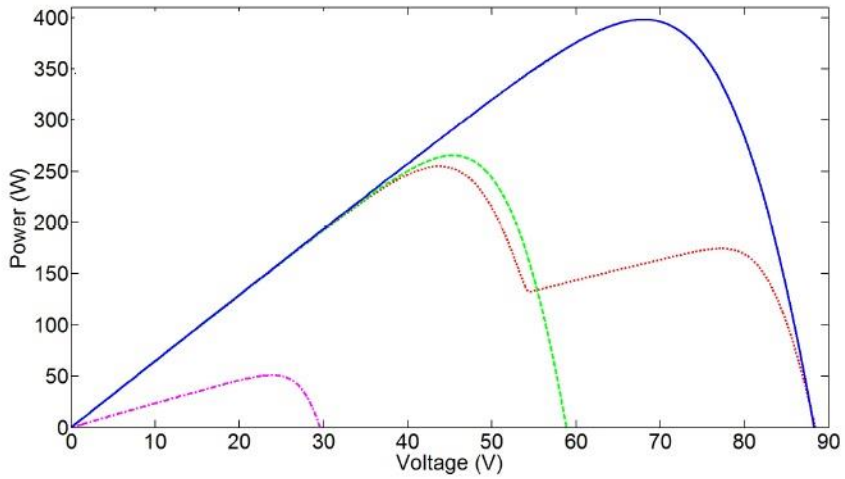

Figure 5: The P-V curves of the string of three unshaded modules, the string of two unshaded modules, the string of two unshaded and one shaded modules and the P-V curve of one shaded module.

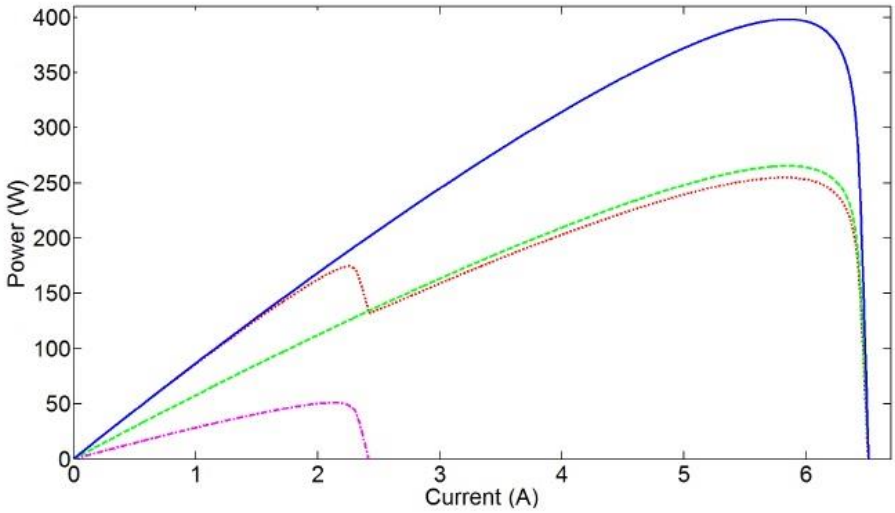

Figure 6: The P-I curves of the string of three unshaded modules, the string of two unshaded modules, the string of two unshaded and one shaded modules and the P-I curve of one shaded module.

4. CONCLUSIONS

PV generators are composed of series and parallel-connected PV modules. To utilize with gird the communication devices are used with PV generator. Partial shading has the negative and harmful effects on PV generator. Parallel connection is less prone to these effects than a series connection. Partial shading occurs due to trees, buildings, dirt accumulation, passing clouds on module frames. In practical always some mismatch losses occur. Thus the effective power of a PV generator is always lower than the rated power of the generator.

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6. REFERENCES

[1] Bose, B. Global Warming: Energy, Environmental Pollution, and the Impact of Power Electronics. IEEE Industrial Electronics Magazine 4(2010)1, pp. 6–17.
[2] Hegedus, S. & Lugue, A. Achievements and Challenges of Solar Electricity from Photovoltaics. In: Lugue, A. & Hegedus, S. Handbook of Photovoltaic Science and Engineering 2, 2011, John Wiley & Sons. pp. 1–16.
[3] Renewable Energy Policy Network for the 21st Century. Renewables Global Status Report 2012. Available at: http://www.ren21.net.
[4] Häberlin, H. Photovoltaics System Design and Practise. UK 2012, John Wiley & Sons. 701 p.
[5] Villalva, M. G., Gazoli, J. R. & Filho, E. R. Comprehensive Approach to Modeling and Simulation of Photovoltaic Arrays. IEEE Transactions on Power Electronics 24(2009)5, pp. 1198–1208.
[6] Qiang, F. Radiation (Solar). In: Holton, J. R., Curry, J. A. & Pyle, J. A. Encyclopedia of Atmospheric Sciences, Volumes 1-6. 2003, Elsevier. pp. 1859–1863.
[7] Markvart, T. Solar Electricity 2nd ed. Chichester 2010, John Wiley & Sons. 280 p.
[8] Wenham, S.R., Green, M. A., Watt, M. E. & Corkish, R. Applied Photovoltaics 2. UK and USA 2007, Earthscan. 336 p.
[9] Fonash, S. J. Solar Cell Device Physics. 2010, Elsevier Inc. 381 p.