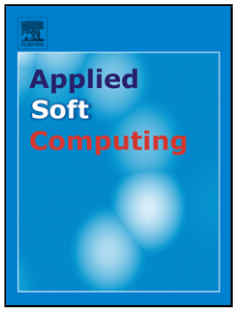

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PII: S1568-4946(18)30358-2
DOI: https://doi.org/doi:10.1016/j.asoc.2018.06.025
Reference: ASOC 4940

To appear in: *Applied Soft Computing*

Received date: 11-4-2017
Revised date: 21-2-2018
Accepted date: 16-6-2018

Please cite this article as: G. Kanimozhi, Harish Kumar, Modeling of solar cell under different conditions by Ant Lion Optimizer with LambertW function, *<![CDATA[Applied Soft Computing Journal]]>* (2018), https://doi.org/10.1016/j.asoc.2018.06.025

Modeling of solar cell under different conditions by Ant Lion Optimizer with LambertW function

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Abstract

The performance of a solar cell is studied by estimating the internal parameters using single diode model. The environmental operating conditions like temperature and solar irradiance also influence the electrical I-V curves that characterize the photovoltaic cell. In this paper, the parameters of the solar cell are extracted using the desired single diode model equations, expressed using LambertW function under the influence of temperature and irradiance through the experimental I-V data using Ant Lion Optimizer implemented in IPython. The simulated results are validated by the obtained low Root Mean Squared Error. The different internal parameters under varied environmental conditions, obtained by the LambertW-based Ant Lion Optimizer are in good agreement with the literature reports and proves to be an effective technique.

Keywords: ALO, LambertW function, temperature, irradiance, IPython.

1. Introduction

Photovoltaic devices are the alternatives for the conventional electricity production by fossil fuels. Effective modeling is required to design efficient and cost-effective photovoltaic energy systems and predict the energy production in the design of solar cells. The photovoltaic systems require an electrical model to investigate the electrical characteristics, a thermal model to study the performance under various changes in temperature and a radiation model to determine the solar energy absorbed by the system. Usually, manufacturers provide the panel parameters at ambient temperature and insolation. The performance of solar panel changes with the changing weather conditions and the angle of mounting. So, we require a model to study the combined analysis of the performance under varied temperature and insolation as it varies from time to time. The models that include the combined analysis of various changes in the operating conditions include analytical models [1] and empirical models [2] based on the physics of photovoltaic systems. These physical models can quantify the electrical output power extracted by the photovoltaic system with the solar radiation assuming that the maximum power is obtained. In order to determine the maximum power extracted by the solar panel, we require the information of I-V characteristics. However, I-V characteristics of the device under study depends on atmospheric temperature and incoming solar radiation. So, the knowledge of the solar cell parameters considering a wide-range of operating conditions is essential to establish the exact performance of the photovoltaic device. These parameters can only

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