

Solar Cell Parameters Extraction Based on Single and Double-Diode Models: A Review

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ABSTRACT

This paper comprehensively describes and discusses the extraction of the DC parameters of solar cells by mathematical techniques based on single-diode and double-diode models. The main parameters of interest are the photocurrent, I_{ph} , the reverse diode saturation current, I_0 , the ideality factor of diode, n , the series resistance, R_S , and the shunt resistance, R_{Sh} . This paper reviews the foremost issues of the condition of the methodologies of the extraction of PV solar cell parameters. This paper classifies the reviewed models on the basis of the number of extracted parameters and provides specific comments for each model. Five parameters from different models that have identical attributes are characterized with respect to irradiance and temperature to demonstrate the behavior and characteristics of these parameters. In addition, this article implements two real models, single-diode and double-diode models, and examines the performance of the PV parameters for each model and its effect on the current–voltage ($I-V$) and power–voltage ($P-V$) characteristics. Furthermore, to assess the accuracy of each model with respect to the data provided by the manufacturer, this paper compares the $I-V$ and $P-V$ curves at standard test condition (STC) and for different parameters for a generic PV panel.

KEYWORDS: PV parameter extraction; $I-V$ characteristics; PV modeling; Single-diode model; Double-diode model

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