Five parameters extraction of single diode PV model by metaheuristic optimization method by identified built-up data

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Article Info	ABSTRACT
	Precision calculation of unknown photovoltaic (PV) modules or single diode models for PV cell specifications under various environmental conditions is needed to build a sunlight-based PV framework. Installing a PV system requires knowledge of all parameters, modeling, and optimization techniques because PV system analysis and configuration help generate renewable energy. This concept requires accurate modeling and calculation of identified and unknown parameters. The single-diode model is simple and accurate for different mathematical equations. Streamlining calculations requires distinguishing this nonlinear model. The current investigation calculated five unknown parameters and compared them with particle swarm optimization (PSO) and wind-driven optimization (WDO) optimization results. The said approach utilizes MATLAB software, analytical as well as optimization methods, and manufacturing data. The suggested method is simple, fast, and accurate for calculating diode ideality factor (A), output currents (I_o), series resistance (R_s), shunt resistance (R_{sh}), and photocurrent (I_{ph}). *This is an open access article under the license.*

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1. INTRODUCTION

In recent days, the demand for different sustainable energy/fuel sources is found to be increasing continuously as they can be an alternative source to fossil fuel as well as a minimum toxic effect on the environment. Among all, solar-based energy sources arise as a potential choice as it is a renewable source of energy. Currently, photovoltaic (PV) plants are normally used by enormous people for energy production and utilization. Concerning its pragmatic execution, the sun-powered PV framework ought to be advanced before its establishment. This can be guaranteed by exact demonstrating, recognizable proof, and recreation of sun-powered PV modules. Solar-based PV represents its current as well as power voltages i.e. (I-V) and (P-V) relations over different temperature conditions and irradiances [1]-[6]. These characteristics and the relation of the I-V and P-V curves of the PV cell or the module were analyzed with various diode (single, double, triple, and multiple) models [7]-[9]. Regarding different article conclusions along with an estimation of unknown parameters for the different diode models, the author has used different methods such as analytical, numerical, and hybrid (a combination of numerical and analytical or called metaheuristic method) [9], [10]. Among all, the metaheuristic optimization method is the best evolutionary method as it deals with the analytical and numerical approach as well as the nonlinear characteristics of the diode model.

In the last decade, different analytical as well as optimization methods were used by different researchers for the estimation of identified and unknown parameters. These methods included biology-based