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Abstract

Extraction of the Optimal Parameters of Single-Diode Photovoltaic Cells Using the Earthworm Optimization Algorithm †

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Abstract: This study introduces a novel method for assessing and deriving the electrical properties of simple diode model solar cells through the utilization of the Earthworm Optimization Algorithm (EOA). Earthworms learn how to avoid barriers and maximize their search in their pursuit of nourishment. In a similar vein, the algorithm imitates this capability by avoiding the problem of concentrating on a local solution. The communication channels between members of the virtual swarm are essential to the optimization process carried out by the earthworm swarm. Through information sharing regarding prospective solutions, these exchanges help to steadily improve the solutions that are eventually accepted by the entire swarm. The virtual cooperation of the "earthworms" increases the effectiveness of solution space exploration and ultimately results in the identification of the mathematical model's ideal parameters. Furthermore, the outcomes obtained via the EOA are contrasted with those derived from other algorithms, namely gray wolf optimizer (GWO), whale optimization algorithm (WOA), sine cosine algorithm (SCA), moth–flame optimization (MFO), ant lion optimizer (ALO), and multiverse optimizer (MVO). Statistical assessments are employed to verify the accuracy of the derived parameters, demonstrating that the theoretical outcomes closely align with experimental data, showcasing superior precision compared to other algorithms.

Keywords: solar cell; electrical characteristics; objective function; earthworm algorithm; optimal model parameters

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