Reliable applied objective for identifying simple and detailed photovoltaic models using modern metaheuristics: Comparative study

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The first issue in the optimal photovoltaic system design is providing an accurate PV model that emulates the system behaviour under several environmental conditions. The accuracy of the photovoltaic model stands on its identified parameters that are mainly based on the executed optimization technique and the employed objective function. As per the literature, two methodologies have been applied for computing the estimated current in the objective function, detecting the most efficient one is the first step for achieving high qualified and precise solutions. Motivated by that, we investigate the two objective functions with considering several novel optimization algorithms. The implemented algorithms are marine predators algorithm, Slime mould algorithm, atom search optimization, Political Optimizer, Parasitism–Predation algorithm as well as harris hawk optimizer and salp swarm algorithm. The Lambert function forms have been used for validating the results. Several profiles of the experimental datasets are measured under different levels of temperature and irradiation conditions to identify the single, double and three diode models parameters of the RTC France solar cell and Canadian-Solar-(CS6P-240P) multi-crystalline solar panel. The main findings show that, applying Newton–Raphson while computing the estimated current in the objective function enhances the algorithms performance to provide the more precise and accurate parameters in comparison with using the measured current and solve the photovoltaic model equation linearly. Moreover, the marine predators algorithm confirms the quality of its solutions and provides a better representation for the photovoltaic datasets with high stability based on the lambert forms and the statistical analyses.

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