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Parameter Identification of Single Diode Model of Photovoltaic Systems

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Abstract

Renewable energy projects have gained a lot of attention globally because of a variety of factors, such as the price of fossil fuel and the potential for degradation as well as social and environmental concerns. The general observation shows that solar power harvesting is growing to satisfy demand for electricity in developing countries, emissions of carbon dioxide and the decrease in the price of PV modules. Solar-based energy systems are most widely used in electricity generation as large-scale PV modules. Solar PV systems are usually simulated by two stages, in which the mathematical model is formulated and the parameters have been chosen.In addition, the actual performance of PV models is often influenced by undefined parameters that may be misunderstood and unreliable as ageing, deterioration and volatile operating conditions of the device are faced on a regular basis. Accurate photovoltaic identification is therefore important for further simulation and configuration of PV systems.

Existing methodologies are usually classified into three types of study, such as empirical methods and numerical methods. In its data sheet, the provider normally offers impressive spots including a power point (V_{MP}), a current limit (I_{MP}) and a short circuit current (I_{SC}) as well as an open circuit tension (V_{OC}) in its datasheet. The accuracy of the parameters estimate by analysis methods depends greatly on the precise position on the characteristics of solar output of solar PV of these specified parameters.The Newton-Raphson (NR) method, Lambert W function, and Gauss Seidel(GS) methods also took many existing numerical approaches into account when estimating those electrical parameters in solar photovoltaics. Although these statistical methods are more reliable than the empirical methods, they also have a longer time to measure convergence. In case of wrong selection of initial values, especially in NR and GS methods, they converge to local maximum rather than global.

Therefore, due to their theorical and mathematical simplicity, metaheuristic algorithms have gained more attention last year and have been used successfully and flexibly for complex problems. Another consideration is that they can perform a high-quality search response with a reasonably quick and efficient search when a proper balance has been achieved between the fundamental modes.The parameters of the PV system were obtained using Artificial Bee Colony (ABC) for different solar models. Further, an improved opposition-based whale optimisation (WOA) algorithm has been tested for the estimation of solar cell diode parameters. Optimizing Moth-flame (MFO) for solar cell parameters extraction was also carried out. MFO implementation was used to achieve the least root means square error (LMSE). While the results of these algorithms are comparatively better than the analytical and computational approaches, some shortcomings such as slow performance and premature convergence continue to be observed. Nevertheless, with several of these heuristic methods, further development is still possible. Harris hawks optimization (HHO) is a metaheuristic process newly proposed. The co-operative acts are the primary influence of HHO, and Harris hawks call surprise pounce their chasing style in nature. Such complex patterns and actions are mathematically imitated to construct an optimization algorithm.