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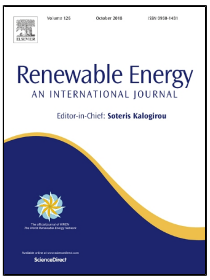

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Maximum likelihood parameters estimation of single-diode model of Photovoltaic generator

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Abstract: In this paper, review on modeling photovoltaic (PV) generator is established first; next, the combination of the optimization method of maximum likelihood estimator (MLE) and Newton Raphson (NR) resolution for identifying unknown parameters of single diode PV module at different test conditions is proposed. This predicted method is compared with generalized least square estimator (LSE) known also as optimization method. The results are also compared with popular predictive methods as Villalva's and Lambert solution. The proposed method is applied for polycrystalline silicon photovoltaic MSX60 solar module at standard test conditions (STC) and at 1000 W/m^2 , 75^{o}C. Two types of comparison are made: first, the dynamic variations of all five parameters values are carried out by graphs and compared in tables with the values found with the other methods (mentioned above); the parameters have converged after up to 150 iterations at STC and the accuracy of estimated parameters is sensitive to the initial parameters of trust region. Secondly, the (I-V) or (P-V) curves are superposed, justifying the accuracy of the proposed method. The comparative errors graphs are also carried out. The results proved the effectiveness of the maximum likelihood estimator, by accuracy parameters of the PV module. An extended study is done for the recent mono-crystalline module CSK6-280M known as Canadian Solar's module. This last study reveals the accuracy for the proposed method during irradiation variation.

Keywords: Parameter estimation, maximum likelihood estimator, single diode model of photovoltaic generator.

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