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Evaluation of Ideal Single Diode Characteristics for Modeling of Solar PhV Cell

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Despite the relatively high cost of solar modules, PhV power systems have been commercialized in many countries for its long term economic prospects and more crucially, the concerns over the environment. These systems, which could be grid- connected or stand-alone, are being installed in wide-ranging power capacities and by using various silicon technologies.

Regardless of the type and size, one critical component of any PhV is the effectiveness of its maximum power point tracker (MPPT). This area has been and is still attracting immense interest from PhV research communities as well as industrial players because it is the most economical way to improve the overall PV system efficiency.

Conceptually, MPPT is a simple problem; it is basically an operating point matching between the PhV array and power converter. However, because of the non-linear I–V characteristics of the PhV curve and the consequence of the varying environmental conditions (particularly insulation and temperature), tracking the correct Maximum Power Point (MPP) can sometimes be a challenging task [1].

The key factor that affects the results of the simulation and accuracy in representation the nonlinear characteristics of the PhV system are modeling. There are different kinds of parametric models presented in various literatures in the past few decades, like single-diode model, two diode models, and much more.

The most commonly used models are single diode and two diode models, as they provide better relations with a practical solar cell keeping in mind the simplicity in implantation and the iteration speed in the extracting parameters as well as I-V and P-V curves also gives minimum error with respect to characteristics of solar PV cell as per manufacturer`s datasheet ,

The ideal single diode model is known to be the most simplified form of an ideal PV cell through which the output voltage and current relations comes out to be calculated.

Thanks to its simplicity it is convenient to use for preliminary calculations to support on-line control of the PhV array in limited time interval.

Literature

Etienne , S. Explicit model of photovoltaic panels to determine voltages and currents at the maximum power point/ S. Etienne, A. Teyssedou // Solar Energy-2011. – vol 85(5), p. 713-22.