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AN INVESTIGATION INTO THE EFFECT OF PHOTOVOLTAIC MODULE ELECTRIC PROPERTIES ON MAXIMUM POWER POINT TRAJECTORY WITH THE AIM OF ITS ALIGNMENT WITH ELECTROLYZER U-I CHARACTERISTIC

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ABSTRACT

In order to combine a photovoltaic module and an electrolyzer to produce hydrogen from water, an intermediate DC/DC converter can be used to adapt output power features of the module to input power features of the electrolyzer. This can also be done without using electronics, which results in saving as much as 700 USD/kW, as previous investigation has shown. A more sophisticated investigation should be carried out with the aim of improving high system efficiency, resulting in matching the photovoltaic module maximum power point trajectory (the maximum power point path in the U-I plane as a result of solar irradiance change) to the operating characteristic of the electrolyzer. This paper presents an analysis of the influences of photovoltaic module electric properties, such as series and parallel resistance and non-ideality factor, on the maximum power point trajectory at different levels of solar irradiance. The possibility of various inclinations (right - vertical - left) in relation to an arbitrary chosen operating characteristic of the electrolyzer is also demonstrated. Simulated results are obtained by using Matlab/Simulink simulations of the well known one-diode model. Simulations have been confirmed with experiments on a real photovoltaic module where solar irradiance, solar cell temperature, electric current, and voltage in the circuit with variable ohmic resistance have been measured.

KEYWORDS

photovoltaic module, series resistance, parallel resistance, non-ideality factor, operating (U-I) characteristic, maximum power point, electrolyzer

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