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Improvement of the Module Temperature Model in 1D5P Forecasting Power Output for Photovoltaic Systems

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Abstract
This paper presents the improvement of the existing module temperature model in forecasting power output for photovoltaic systems. The proposed module temperature model was developed by using a weight function technique. The weight function technique was created by using annual data on a module temperature and solar irradiance. Then the researchers adjusted the simulated graph trend to measure the weight function. The results showed the behavior of the proposed module temperature and confirmed accuracy by comparison of measured data. It was found that the root-mean-square error (RMSE) of the existing module temperature model ranged from 0.0257 to 0.0758 and the average RMSE was 0.0512, and the root-mean-square error (RMSE) of the proposed module temperature model adjusted by weight function ranged from 0.024 to 0.076, and the average RMSE was 0.0491.

Keywords: *Module Temperature Model, weight function, root-mean-square error*

1.Introduction

One part of the renewable energy technologies is photovoltaic energy. The Photovoltaic power has been rapidly growing worldwide as one of the lowest cost options for generating electricity (International Energy Agency, Trends 2015 in Photovoltaic Applications, 2015). The amount of power from photovoltaic energy depends on solar irradiance and module temperature (Garcia & Balenzategui, 2004).

The Module Temperature Model often works with the Forecasting Model of Power Output in Photovoltaic Systems. The Module Temperature is one part of the input for 1D5P Forecasting Model (Chouder et al., 2012; Ciulla et al., 2014). The 1D5P power output forecasting model was an essential factor for the design and installation of the photovoltaic systems. Generally, the 1D5P Forecasting Model of Power Output for Photovoltaic System uses two input parameters consisting of solar irradiance and module temperature. The temperature model was developed to integrate with the forecasting model 1; its input parameter was employed to simplify the model (Dawan et al., 2018).

This research studied the improvement the Module Temperature Model in 1D5P Forecasting of Power Output for Photovoltaic Systems by a weight function technique. The power plants in Thailand have studied types of polycrystalline solar cells. The module is 245 Wp/module. The module temperature model was verified for the purpose model by comparison with measured data.