

Estimating Solar Irradiance on a Tilted Surface Using Artificial Neural Networks with Differential Outputs

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Abstract : Photovoltaics modules are usually not installed horizontally to avoid water or dust accumulation. However, the measured irradiance data on tilted surfaces are rarely available since installing pyranometers with various tilt angles induces high costs. Therefore, estimating solar irradiance on tilted surfaces is an important research topic. In this work, artificial neural networks (ANN) are utilized to construct the transfer model to estimate solar irradiance on tilted surfaces. Instead of predicting tilted irradiance directly, the proposed method estimates the differences between the horizontal irradiance and the irradiance on a tilted surface. The outputs of the ANNs in the proposed design are differential values. The experimental results have shown that the proposed ANNs with differential outputs can substantially improve the estimation accuracy compared to ANNs that estimate the titled irradiance directly.

Keywords : photovoltaics, artificial neural networks, tilted irradiance, solar energy

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