

Development of a prediction model for output power reduction of PV solar panels based on environmental parameters using Particle Swarm Optimization technique

ABSTRACT

Design guidelines for solar panels regarding the environmental parameter's influence over the solar panel power output are limited. This study proposes an output power percentage reduction model for predicting the effect of environmental parameters (ambient temperature, wind speed, relative humidity, dust accumulation and rain amount) using Particle Swarm Optimization (PSO). The PSO technique prevents an exhaustive traditional trial-and-error procedure for obtaining the set of the unknown coefficients of the proposed model. A total of 244 databases were collected from the literature and divided into two parts. The first set which comprises 194 data sets were used to build the proposed model while 50 datasets as the second set were used in the verification process. Three performance measures, namely mean absolute, mean absolute percentage and root mean square errors were used in the proposed model to ensure the accuracy of the study. The design procedure and accuracy of the proposed model are illustrated and analyzed via simulation tests in MATLAB Software. The results show the applicability of the PSO technique to solve the solar energy problems. This technique can be adopted as an effective tool to explore the optimal solutions for the growth of the power reduction of solar panels with the different environmental parameters and provided a design guideline for solar panel site.

Keyword: Environmental parameters; Power reduction; Particle Swarm Optimization (PSO); Solar panel; PSO technique; MATLAB software