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ORIGINAL ARTICLE

A new metaheuristic-based MPPT controller for photovoltaic systems under partial shading conditions and complex partial shading conditions

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Abstract

Solar photovoltaic energy is the potential energy in the universe for generating electricity and meeting the required load demand. However, on account of partial shading conditions, the difficult task in the PV system is to track global maxima instead of local maxima and maintain the uninterrupted power supply. To solve this problem, a new metaheuristic algorithm is introduced in this paper such as a heap-based optimizer (HBO). The proposed method is developed in MATLAB/Simulink software. The system is examined under distinct irradiation conditions and compared their performance with other methods. The simulation results reveal that the suggested HBO shows a reliable enhancement as compared to other studied methods with regard to tracking maximum power, convergence time, and settling time. The extracted power efficiencies are 99.85% for case 1, 99.96% for case 2, and 99.92% for case 3. It is found that HBO shows better enrichment than other studied methods.

Keywords Solar photovoltaic · Partial shading conditions · Maximum peak power · HBO · MPSO

Abbreviations

SPV	Solar photovoltaic
PSC	Partial shading conditions
GM	Global maxima
LM	Local maxima
EVs	Electric vehicles
MPPT	Maximum power point tracking
MPP	Multiple peak power
PS	Partial shading
HBO	Heap-based optimizer
IGWO	Improved grey wolf optimization
ANN	Artificial neural networks
PSO	Particle swarm optimization
ABC	Artificial bee colony
MPSO	Modified particle swarm optimization
SPSO	Standard particle swarm optimization
P&O	Perturb and observe
INC	Incremental conductance
CC	Constant current
CV	Constant voltage
FLC	Fuzzy logic control
ACO	Ant colony optimization
BAT	Bat
CS	Cuckoo search
CSO	Cat swarm optimization
DE	Differential evolution
FA	Firefly algorithm
SSA	Salp swarm algorithm
GA	Genetic algorithm
GWO	Grey wolf optimization
DFA	Dragon fly optimization
WOA	Whale optimization algorithm

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