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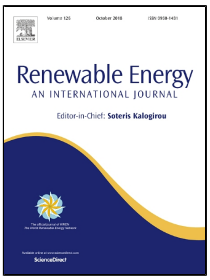

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Particle swarm optimization algorithm for Optical-geometric optimization of Linear Fresnel solar concentrators

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ABSTRACT

In this work we propose the application of the particle swarm optimization (PSO) method to Optical-geometric optimization of linear Fresnel reflector solar concentrators (LFR). The optical-radiative behavior of the system is modeled based on the Ray tracing-Monte Carlo algorithm that calculates the optical performances and the radiative energy collected by the absorber tube. For this system, the application of particle swarm optimization method for optical optimization has not been studied yet. For this reason, testing this method and developing its strategy of implementation in the case of Fresnel concentrator system is one of other objective of this work. In that sense, we present mainly the coupling strategy between the Monte Carlo-ray tracing algorithm and the particle swarm optimization method. In first, the PSO optimization algorithm established is validated by comparison with a deterministic method results. Then, we demonstrated the ability of the method to resolve optimization problem with high number of decision parameters and complex objective function. Subsequently, the various guidelines allowing the rational use of this method in the case of linear Fresnel systems optimization are proposed and discussed. Subsequently, the optimization algorithm is applied to the case of linear Fresnel concentrator module designed in the framework of SIROCCO project.

Keywords-Concentrating solar power, Linear Fresnel Reflector, Ray tracing technique, CPC collector, optical performance, particle swarm optimization.

Nomenclature

LFR	Linear Fresnel Reflector
PSO	Particle Swarm Optimization
CPC	Compound Parabolic Concentrator