



Optimization of corrugated-receiver solar collector's geometry using LBM analysis based on curved boundary scheme

Emad Hasani Malekshah ^a , Magda Abd El-Rahman ^{b,c}, S. Mohammad Sajadi ^d,
Hikmet Ş. Aybar ^{e,f} , A.S. El-Shafay ^{g,h}

Show more 

 Add to Mendeley  Share  Cite

<https://doi.org/10.1016/j.jtice.2023.104728>

[Get rights and content](#) 

Abstract

Background

Due to growing demand of renewable energy for reducing the air pollution and costs, the optimization of the thermal systems using the renewable energy are attractive for the researchers. At this end, a parabolic trough solar collector, which converts the solar radiation to consumable heat energy for the daily use, is studied by numerical approach. This solar collector is consisted by a reflector gathering the solar radiation, corrugated solar receiver and inner tubes.

Methods

The lattice Boltzmann method (LBM) is utilized to solve the governing equations, and the curved boundary approach is taken into account to treat with the curved boundaries. With this combination, the accuracy and reliability of the results may be guaranteed. Using Koo-Kleinstreuer-Li (KKL) correlations, the Al_2O_3 -water nanofluid's thermal/physical parameters, such as thermal conductivity and dynamic viscosity, are predicted before being inserted into the collector.

Significant Findings

Rayleigh number ($10^3 < Ra < 10^6$), nanoparticle concentration ($0 < \phi < 0.04$), and receiver geometry were all examined variables. In addition, the main goal of the present work is to find an optimized geometry for the receiver of a solar collector. The hydrothermal efficiency and the second law analysis are the basis of the optimization.