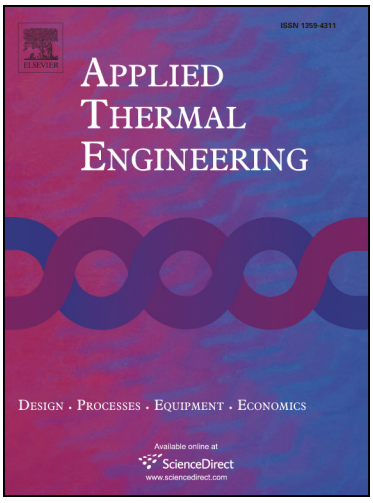

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Performance optimization of a two-phase closed thermosyphon through CFD numerical simulations

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Abstract

In this paper, a comprehensive computational fluid dynamics (CFD) modeling was built to reproduce the pool boiling in the evaporator section and the liquid film condensation in a closed thermosyphon. The two phase Volume Of Fluids (VOF) model was used to simulate the heat transfer during evaporation and condensation inside a closed thermosyphon. This CFD model was validated using experimental results, and a good agreement was observed. Moreover, the results were analyzed in terms of the vapor volume fraction variation, temperature and vertical velocity at different locations along the thermosyphon. A parametric study was also conducted to enhance the performance of the thermosyphon designed for solar thermal energy applications like domestic hot water systems. It is found that the performance of the two-phase closed thermosyphon can be improved by tilted fins integration on the lateral surface of the condenser section.

Keywords: Two-phase closed thermosyphon; Computational Fluid Dynamics ; Evaporation; Condensation

Highlights

- CFD modelling of the two phase flow in closed thermosyphon.
- Good agreement between numerical results and experiments data.
- Optimization of the performance of the closed thermosyphon.

1. Introduction

Heat pipes (HP) are often encountered in many engineering applications due to their excellent two-phase heat transfer capabilities [1, 2]. In a heat pipe, heat is absorbed by the evaporator and transported to the condenser region where the vapor condenses by transferring heat to the cooling media. A group of HP that fluid circulation happens inside them due to gravity called Two-Phase

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