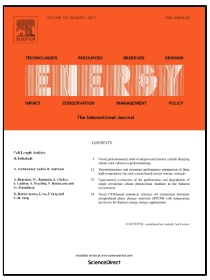
Accepted Manuscript



Multi-Objective Optimization of Nanofluid Flow in Double Tube Heat Exchangers for Applications in Energy Systems

Mohammad Hemmat Esfe, Hadi Hajmohammad, Davood Toghraie, Hadi Rostamian, Omid Mahian, Somchai Wongwises

PII:	S0360-5442(17)31101-5
DOI:	10.1016/j.energy.2017.06.104
Reference:	EGY 11112
To appear in:	*Energy*
Received Date:	13 June 2016
Revised Date:	26 May 2017
Accepted Date:	18 June 2017

Please cite this article as: Mohammad Hemmat Esfe, Hadi Hajmohammad, Davood Toghraie, Hadi Rostamian, Omid Mahian, Somchai Wongwises, Multi-Objective Optimization of Nanofluid Flow in Double Tube Heat Exchangers for Applications in Energy Systems, *Energy* (2017), doi: 10.1016/j.energy.2017.06.104

.

Multi-Objective Optimization of Nanofluid Flow in Double Tube Heat Exchangers for Applications in Energy Systems

Mohammad Hemmat Esfe[1], Hadi Hajmohammad[1], Davood Toghraie[1], Hadi Rostamian[1], Omid Mahian[2*], Somchai Wongwises[3]

[1]Department of Mechanical Engineering, Khomeinishahr Branch, Islamic Azad University, Isfahan, Iran

[2] Renewable Energies, Magnetism and Nanotechnology Lab., Faculty of Science, Ferdowsi University of Mashhad, Mashhad, Iran

[3]Fluid Mechanics, Thermal Engineering and Multiphase Flow Research Laboratory (FUTURE Lab.), Department of Mechanical Engineering, King Mongkut's University of Technology Thonburi, Bangmod, Bangkok 10140, Thailand

*Corresponding author E-Mail:omid.mahian@gmail.com

Abstract

The optimization of MgO-water nanofluids in order to reduce the cost and increase the heat transfer coefficient is investigated in this study. At first, the heat transfer coefficient is obtained at various values of solid volume fractions, diameters of nanoparticles, and Reynolds numbers based on empirical data. The cost amount is also determined in terms of solid volume fractions and diameters of nanoparticles. Then, the heat transfer coefficient function and the cost function are attained via RSM (Response Surface Method) and with a regression coefficient of over 0.997. The optimization is performed by the non-dominated sorting genetic algorithm which has a significant capability of achieving optimal response. Finally, the Pareto front, the optimal heat transfer coefficient, and their corresponding minimum cost have been obtained. An appropriate correlation is also provided to achieve the optimal model of the minimum cost in terms of the maximum heat transfer coefficient. Optimization results have shown that, compared to the first optimization, the cost has decreased about 38% in the best case.

Keywords:

Multi-objective optimization; Response surface method; Nanofluid; Heat transfer coefficient