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Coefficient of performance prediction by a polynomial of a heat transformer with two-duplex components

C. Ramírez-Hernández [a], B.A. Escobedo-Trujillo [a], D. Colorado [b,*], F.A. Alaffita-Hernández [c], L.I. Morales [d], J.A. Hernández [e]

[a] *Facultad de Ingeniería, Universidad Veracruzana, Campus Coatzacoalcos, Av. Universidad Km, 7.5, col. Santa Isabel, C.P. 96535 Coatzacoalcos, Veracruz, Mexico*
[b] *Centro de Investigación en Recursos Energéticos y Sustentables, Universidad Veracruzana, Campus Coatzacoalcos, Av. Universidad Km, 7.5, col. Santa Isabel, C.P. 96535 Coatzacoalcos, Veracruz, Mexico*
[c] *Facultad de Matemáticas, Universidad Veracruzana, Circuito Gonzalo Aguirre Beltrán S/N, Zona Universitaria, C.P. 91090 Xalapa, Veracruz, Mexico*
[d] *Escuela de Estudios Superiores de Xalostoc, Universidad Autónoma del Estado de Morelos (UAEM), Mexico*
[e] *Centro de Investigación en Ingeniería y Ciencias Aplicadas, Universidad Autónoma del Estado de Morelos, Av. Universidad 1001, col. Chamilpa, C.P. 62209 Cuernavaca, Morelos, Mexico*

HIGHLIGHTS

- Four polynomial models were developed to predict COP.
- Models presented an excellent agreement between experimental and simulated COP.
- The polynomial methodology could be used to simulate others absorption systems.

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ABSTRACT

Polynomial models were developed to predict the coefficient of performance of a heat transformer with a new compact design consisting of a generator-condenser and an absorber-evaporator with a heat load of 2 kW. The operational coefficients of performance ranged from 0.100 to 0.369. Temperature, pressure and concentration of a water lithium bromide solution were measured at different points of the inlet and outlet streams of the main components of the heat transformer. In order to build four polynomial models we calculated a correlation matrix and selected the best independent variables. The best polynomial model included inlet temperature in the generator, absorber-generator, and evaporator; output temperature in the absorber-generator, and pressure in the generator. The developed models showed an excellent correlation between experimental and simulated values of the coefficient of performance with a coefficient of determination $R^2 \geqslant 0.9910$.

1. Introduction

This research shows the use of a polynomial fitting method to predict the coefficient of performance of an absorption heat transformer built with compact components. The experimental database is obtained from the new design of an absorption heat transformer operating with a lithium/bromide solution mixture used by Morales et al. [1]. The purpose of this work is to provide faster and simpler solutions in order to obtain accurate predictions during the analysis of the heat transformer, instead of using complex equations.

Polynomial fitting is an attractive technique employed to estimate the degree of relationship between independent and dependent variables. Recently, thermal engineering processes and heat transfer problems have been solved with the aid of polynomial approaches. For instance, Bogdan and Constantin [2,3] used a polynomial fitting method to compute the solution of differential equations describing heat transfer by introducing a squared remainder minimization method (SRMM) as a straightforward and efficient way to compute approximate polynomial solutions for nonlinear heat transfer problems. Polynomials of 2nd, 3rd, 4th and 8th order are found and compared with others methods reported in the literature getting errors below 0.01. Bogdan and Constantin [3] computed analytical approximate polynomial solutions for some classes of Lane-Emden type equations. Polynomial results were

* Corresponding author.
E-mail address: dcolorado@uv.mx (D. Colorado).

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