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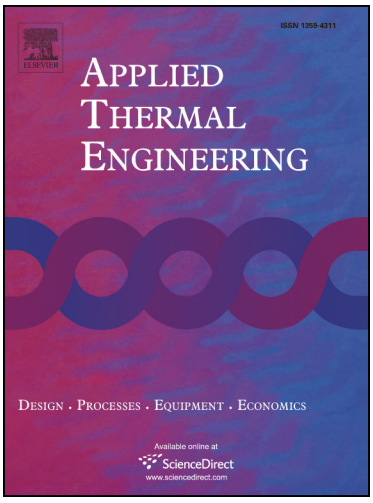

Research Paper

A novel method for combined entropy generation and economic optimization of counter-current and co-current heat exchangers

Srbislav Genić, Branislav Jaćimović, Andrija Petrovic

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ACCEPTED MANUSCRIPT

A NOVEL METHOD FOR COMBINED ENTROPY GENERATION AND ECONOMIC OPTIMIZATION OF COUNTER-CURRENT AND CO-CURRENT HEAT EXCHANGERS

Srbislav Genić, Branislav Jaćimović, Andrija Petrovic[1]
University of Belgrade, Faculty of Mechanical Engineering
Department of Process Engineering
Kraljice Marije 16, 11000 Belgrade, Serbia

HIGHLIGHTS

- A novel method of entropy generation minimization has been proposed.
- Expressions for a number of entropy generation units (NEGU) have been provided.
- Entropy generation minimization methodology has been performed on a case study.
- It is showed that the minimum NEGU corresponds to the minimum total annual costs.

Abstract

In this paperwork, a novel methodology of entropy generation minimization (EGM) for counter-current and co-current heat exchangers is developed. The methodology can be applied in general case for all types of the heat exchangers with the counter-current and co-current flow configuration. A number of entropy generation units (*NEGU*) function, along with its pressure drop and temperature difference components, are presented. Additionally, evaluated EGM can be easily incorporated into some optimization algorithms for industrial practice. Beside of the theoretical background, on an example and case study were proved that the EGM analysis could be useful in practical applications of heat exchanger optimization. Furthermore, the correlation between the minimum value of *NEGU* and minimum of total annual costs (operational and investment costs) have been shown. Based on the EGM methodology, on a case study was presented that pressure drop of the plate counter-current heat exchangers in series should be 36 kPa, in order to achieve minimal annual costs of the 456 EUR/year. The result corresponds to the heat exchangers in series with 2 sections and 46 plates per section.

Keywords: entropy generation minimization, heat exchanger, counter-current, co-current

Nomenclature

[1] Corresponding author. Tel. +381-62-295-278 E-mail: aapetrovic@mas.bg.ac.rs

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