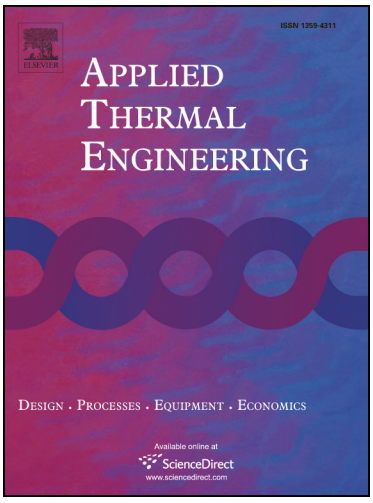

A new stage-wise superstructure for heat exchanger network synthesis considering substages, sub-splits and cross flows

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A new stage-wise superstructure for heat exchanger network synthesis considering substages, sub-splits and cross flows

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Abstract Several optimization models for process synthesis and optimization are derived from superstructures. Those used for Heat Exchanger Networks (HEN) must comprise consistent design options so that efficient structures may be found. The complexity arisen from nonlinearities and non-convexities in the mathematical models for HEN synthesis, though, hampers the use of superstructures with elaborated streams splits and mixing alternatives as well as multiple options for devices allocation. In this work, a new superstructure based on a previous stage-wise one is presented encompassing, for each process stream, the use of splits, sub-splits, cross flows (i.e., partial stream mixing), serial heat exchanger allocation in single stream split branches and heaters/coolers allocation in intermediate stages of the structure (i.e., before process streams heat exchangers). The meta-heuristic approach used to solve the optimization model was able to achieve solutions better than those previously reported in the literature for five case studies, demonstrating efficiency in solving such complex model.

Keywords: optimization; heat exchanger networks; meta-heuristics; mathematical modeling; process synthesis

1 Introduction

Mathematical programming (MP) has been a successful basis for several HEN synthesis works, providing a fair degree of automaticity to a complex design and optimization task. Among the frameworks presented in the literature to conduct HEN synthesis, two MINLP formulations can be highlighted as noteworthy contributions to the field. Those are the generalized match-

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