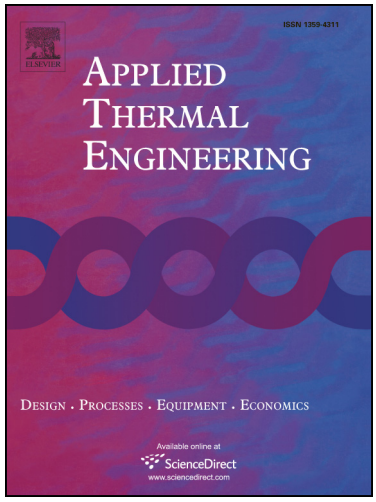

Gravitational search algorithm for economic optimization design of a shell and tube heat exchanger

Dillip Kumar Mohanty

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Title: Gravitational search algorithm for economic optimization design of a shell and tube heat exchanger

Dillip Kumar Mohanty

School of Mechanical Engineering, VIT University, Vellore, Tamilnadu, India

Abstract:

A new design optimization approach using the gravitational search algorithm is developed to obtain optimal configuration of a shell and tube heat exchanger from economic point of view. The objective function considered for the optimization process is the total annual cost including the investment cost and the operating cost. The Gravitational Search Algorithm (GSA) is a heuristic search algorithm based on the law of gravity and mass interactions. Taking into account the importance of shell and tube heat exchangers in industrial applications and the complexity in their geometry, the GSA methodology is adopted to obtain an optimal geometric configuration. The developed algorithm is applied to two case studies and the results are compared with the original design and other optimization methods available in literature such as Genetic Algorithm (GA), Particle Swarm Optimization (PSO), Artificial Bee Colony (ABC), Bio-geography Based Optimization (BBO), Cuckoo Search Algorithm (CSA) and Firefly Algorithm (FFA). The simulation results show that the operating cost can be reduced by 61.5% while the total cost can be reduced by 22.3% as compared to the original design for a shell and tube heat exchanger of heat duty 4.34MW. The comparison of the obtained results with other algorithms indicates that the GSA algorithm can be successfully applied for design optimization of a shell and tube heat exchanger from economic point of view.

Keywords: Shell and tube heat exchanger; Overall heat transfer coefficient; Optimization; Gravitational search algorithm; Law of Gravity.