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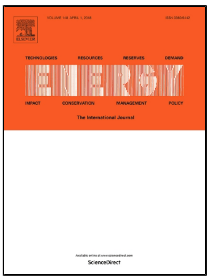

A novel random walk algorithm with compulsive evolution combined with an optimum-protection strategy for heat exchanger network synthesis

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A novel random walk algorithm with compulsive evolution combined with an optimum-protection strategy for heat exchanger network synthesis

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Abstract: Random walk algorithm with compulsive evolution is a novel stochastic method with strong global search ability for heat exchanger network synthesis; however, its mutation behavior of accepting bad solutions might substitute excellent solutions with bad ones and consequently cost-optimal structures cannot be guaranteed. Therefore, an optimum-protection strategy is proposed to protect and exploit excellent solutions. In the presented method, a basic population is set to generate numerous candidate solutions based on the evolution principle of original algorithm, where the excellent solutions including current optimums and pseudo optimums are delivered to a protective population. For higher convergence precision, a dimensionality-reduction random walk technique is designed for the protective population to perform a complete local optimization for the protected solutions. The presented method consisting of two populations can maintain the normal evolution of original algorithm and exploit the potentialities of the excellent solutions, which can satisfy the needs of global and local search abilities. Moreover, a leader–follower optimization technique is presented to reduce computational time when considering stream splits. Five different-sized cases available in the literature are systematically examined and some more economical solutions compared to the reported ones are found within reasonable time.

Keywords: Heat exchanger network; Random walk algorithm with compulsive evolution; Optimization; Stochastic methods; Optimum-protection strategy