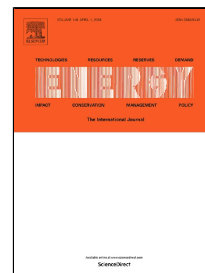


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A novel random walk algorithm with compulsive evolution combined with an optimum-protection strategy for heat exchanger network synthesis

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

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

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

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