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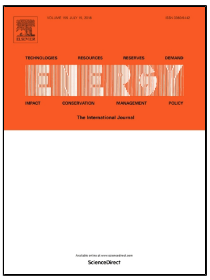

An industrial facility layout design method considering energy saving based on surplus rectangle fill algorithm

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An industrial facility layout design method considering energy saving based on surplus rectangle fill algorithm

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Abstract: The facility layout design within a plant is a key step in the process of chemical engineering design. A good layout can save capital cost, energy and natural resource. The aim of this work is to determine the relative location of facilities in a large-scale industrial plant considering multi-floor structure to make the total cost minimum. The objective function consists of piping investment cost, pump power cost, land cost, and floor construction cost. Surplus rectangle fill algorithm is applied in this work, and it is combined with a genetic algorithm to obtain the optimal solution. Constraints of pump area, joint arrangement of heat exchangers, and the cross-floor facilities are also taken into consideration. In the case study, a plant from a real refinery including 217 facilities is designed with different floor number. The comparison of the three different conditions proves the important role of floor number in the trade-off among investment cost, energy consumption, and land resource. The case illustrates that, the proposed method can generate a reasonable layout design for the industrial facilities and save capital and operating cost effectively. A sensitivity analysis is also done to explore the influence of basic data on the optimal construction structure.

Key words: Facility layout; multi-floor layout; surplus rectangle fill algorithm; genetic algorithm