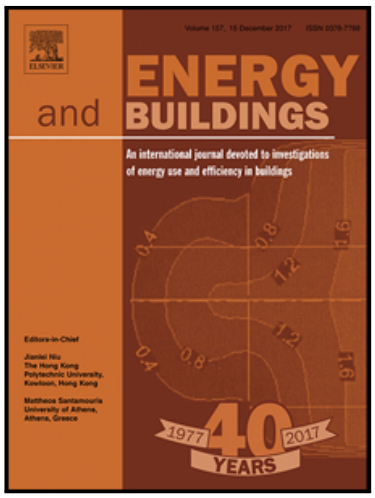

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Optimal Chiller Loading for Saving Energy by Exchange Market Algorithm

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Abstract

The energy consumption in a multi-chiller system is very significant and its consumption will be increased by inappropriate operating of the chillers. Accordingly, the economic dispatch in multi-chiller systems becomes an important issue for saving energy. Such issue is known as optimal chiller loading, which is solved by applying different optimization methods. This study employs exchange market algorithm to obtain optimal set points of the economic dispatch problem on chiller plants, which is inspired by trading the shares on a stock market. Exchange market algorithm is proposed for solving continuous non-linear optimization problems and it is comprised of two searching and two absorbing operators. The decision variable of the optimal chiller loading is partial load ratio of each chiller and the objective function of the optimal chiller loading problem is minimizing the power consumption while satisfying the cooling demand. This paper adopts three case studies to evaluate the performance of exchange market algorithm and compares it with other optimization methods applied on the optimal chiller loading problem. Results show that exchange market algorithm is an efficient method for solving optimal chiller loading problem in chiller plants, and is adaptable for usage in air-conditioning systems. In addition, the comparison results show that the exchange market algorithm provides better solutions than previous optimization methods applied on the optimal chiller loading method in terms of convergence speed and total consumption of electrical energy.

Keywords: Economic dispatch, optimal chiller loading, exchange market algorithm, energy saving.

Nomenclature

P_i	Power consumption of the i^{th} chiller
PLR_i	The partial load ratio of the i^{th} chiller unit
a_i, b_i, c_i and d_i	The power consumption coefficients of the i^{th} chiller
m	The number of chillers
RT_i	Refrigeration ton