A Direct Optimal Control Strategy for Valves in Heat Exchanger Networks and Experimental Validations

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Abstract

Optimal operations of heat exchanger networks (HENs) are of great significance to energy conservation. As one of the most efficient methods to reduce the running costs of HENs, the pressure differential set points control strategy has been widely applied in practice, where the optimal pressure differentials of different sections are obtained by suitable empirical and mathematical models, and then the optimal pressure differentials are passed to control systems to guide the operations of each component. Most control systems in these methods are indirect control strategies. That is, it will take a long time to seek the operating parameters of each component due to the lack of direct operating parameters. Based on the newly proposed thermal resistance-based optimization method, we introduce a direct optimal control strategy for adjustable valves in HENs to obtain the optimal valve openings directly with the full awareness of HENs in physics. Finally, we take a variable water volume chiller system as an example to validate the proposed control strategy. Groups of experiments and the results illustrate the proposed direct valve control strategy of the HEN.

Keywords: heat exchanger networks; energy conservation; valve opening; control strategy.