A systematic strategy for multi-period heat exchanger network retrofit under multiple practical restrictions

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A systematic strategy for multi-period heat exchanger network retrofit under multiple practical restrictions☆1

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Abstracts A systematic strategy for retrofit of the multi-period heat exchanger network (HEN) on the basis of the multi-objective optimization is developed. In this three-stage procedure, a simplified multi-objective optimization model of the multi-period HEN is first established and then solved to target the retrofit, aiming to minimizing the total annual cost and total annual CO_2 emissions. The obtained Pareto front represents series of retrofit targets under different emission limitations, from which the most desirable one can be selected. The matching of the existing and the required heat exchangers is further implemented to finalize the retrofit, which will meet the practical retrofit requirements and matching restrictions. The application of the proposed procedure is illustrated through a case study of a HEN in a vacuum gas oil hydro-treating unit.

Key words: heat exchanger network; multi-period operation; CO_2 emission; retrofit restrictions

1 INTRODUCTION

Heat exchanger network (HEN) is one of the most important energy utilization sub-systems in process industries, such as oil refining, petrochemical processes, steel, pharmacy and food[1]. A well-designed HEN benefits both the economic and environmental sustainability[2, 3]. However, the variation of production plan and ambient conditions may cause the existing HEN, designed at fixed operation condition, becomes insufficient to the variable or multi-period operations[4]. Moreover, the existing HEN, designed years ago, may fail to meet the economic and emission requirements due to increasing energy cost and tighter environmental regulations[5]. Thus, a favorable retrofit of the HEN should not only satisfy the multi-period operations, but also meet the economic and emission requirements through proper retrofit actions. This problem can thus be formulated as a multi-objective optimization problem of multi-period HENs. However, the present research on

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