Retrofit of Heat Exchanger Networks Considering Existing Structure: A New Targeting Procedure

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ABSTRACT: *A new retrofit targeting procedure, based on pinch technology has been developed. The new procedure considers existing structure of a given network and finds the most compatible configuration with the network. To achieve this aim, the procedure uses a linear programming technique that maximizes the compatibility. Good compatibility between old and new networks helps to make the best use of capital in retrofit projects.*

The procedure has been tested by doing two case studies, in which the results compared to other established methods, and realized significant improvement.

KEY WORDS: Pinch technology, Retrofit, Heat exchanger networks, Targeting, Network Structure, Area matrix

INTRODUCTION

Retrofit of heat exchanger networks using pinch technology, is the main part of process integration technology. During retrofit, energy consumption of processs is reduced by improving energy efficiency of heat exchanger network. To achieve this purpose, new area in the network is installed. The cost of additional area against energy saving defines project economics. The project scope will be set according payback period and / or investment limit.

During the past two decades, many retrofit procedures have been developed and applied to different process industries. *Tjoe* and *Linnhoff* [1] proposed the first Pinch retrofit method and introduced the concept of Area Efficiency of HEN's. *Shokoya* and *Kotjabasakis* [2] proposed a technique based on area distribution matrix that overcomes the limitations introduced by Tjoe's method. *Polley* and *Panjeh Shahi* [3] extended the targeting and design procedures of Tjoe and Linnhoff by considering stream allowable pressure drops.

In recent years, *Nie* and *Zhu* [4] proposed a decomposition strategy in which the unit-based model is used to indicate which units require additional area, then special attention is paid to these units, in terms of pressure drop constraints. Thus, units with and without additional area requirements are treated differently during optimization. *Zhu* and *Asante* [5] also proposed a diagnosis and optimization approach for retrofitting. This approach searches for topology changes in diagnosis stage, followed by an evaluation and cost optimization stages. Promising modifications are selected from the diagnosis stage and assessed in terms of the impacts on implementation cost, operability and safety.

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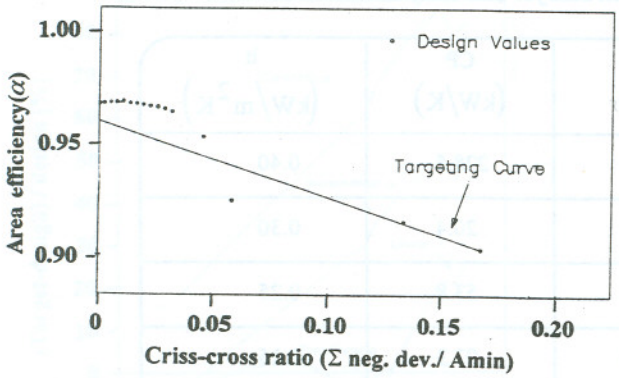

Fig. 15: Variation of area efficiency versus criss-cross ratio for case study 2

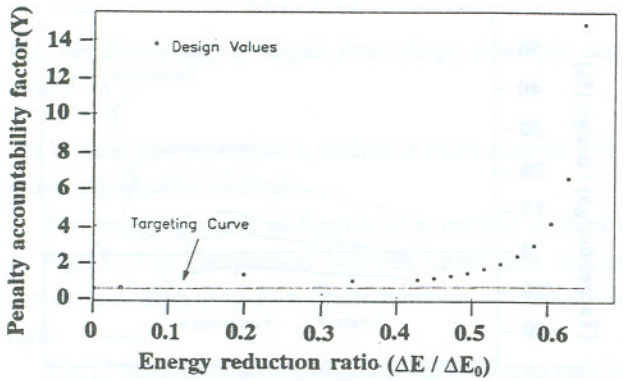

Fig. 16: Variation of penalty accountability factor versus energy reduction ratio for case study 2

target and design shows penalty accounability factor (Y) is not a linear function of energy reduction ratio ($\Delta E/\Delta E_0$). Also, it shows the design values of Y are greater than one in some points. Though, in linear Y method the maximum value of Y is one.

CONCLUSION

The criss-cross ratio, defined in this paper, is an important parameter when performing range targeting in retrofit. According to this parameter, a new method (functional α) has been established which considers the existing structure of the network and uses linear programming technique to find the most compatible structure with the existing structure. By performing two case studies, It is shown that the method is more accurate and reliable than other methods.

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