

Executive Summary

Heat Exchanger Network Retrofit

The retrofit of heat exchanger networks (HEN) is a complicated process to design and implement. Several solutions to the retrofit problem have been suggested. This paper will compare two specific approaches and evaluate the most effective and useful methodology. Also, this paper will attempt to improve process pinch technology by incorporating optimization software and other techniques.

Mixed Integer Linear Programming

The Mixed Integer Linear Programming (MILP) methodology allows the user to tailor the program for very specific scenarios. This is beneficial for the retrofit application because industrial retrofit problems are numerous and varied. The MILP maintains the intricateness of the retrofit problem by not making any of the classical simplifying assumptions. Another benefit of the MILP is the ability to easily change the objective function, which allows the user to optimize a variety of cost functions.

Process Pinch

The process pinch methodology is based on thermodynamic principles that set energy savings and cost targets prior to the design of a HEN. The goal of pinch analysis is to maximize the process-to-process heat recovery and minimize the utility requirements of a system. The pinch method allows the engineer to locate specific regions within the current network where process change will result in a reduction of the overall energy consumption of the system.

Process Pinch Improvements

This work presents improvements to the process pinch methodology which include allowing the relocation of existing heat exchangers and the incorporation of software optimization. The relocation of existing heat exchangers has an associated fixed cost which, in some cases, may be less than the costs associated with the addition of a new heat exchanger. Also, the incorporation of software optimization with the process pinch methodology allows Pro-II to optimize heat exchanger areas while maintaining stream target temperatures. This optimization procedure was applied to the optimal HEN exchanger location generated from the process pinch methodology.

Discussion

From the comparison of the above listed technologies, it was found that the MILP was the superior methodology based on ease and timeliness of use, as well as the ability to tailor the program to solve a wide range of retrofit problems. The limitations of the pinch technology, even with the addition of the improvement methods, make it the less preferred method in an industrial setting.