

Research topics

Design of Heat Exchanger Networks

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Abstract

The design of complex heat exchanger networks currently requires an expert practitioner. This project has developed automated approaches to the design of new heat exchanger networks that allow designers with less specialist expertise to produce high quality network designs. Heat exchanger network retrofit might be debottlenecking for increased throughput or increased energy recovery, or reduced flue gas emissions. This project has provided powerful new techniques that automate retrofit design but also, importantly, allow user interaction at the critical design stages. The designs produced involve the minimum number of modifications to existing networks.

Project description

Practical methods have been developed for the automated synthesis of new heat exchanger networks. In addition to trading off energy and capital costs, the new methods allow for multiple utilities, constrained matches, variable heat transfer coefficients and different cost laws for exchangers.

For retrofit of heat exchanger networks, the objective might be to increase throughput, to reduce energy costs or to reduce flue gas emissions or any combination of these. Current industrial practice uses pinch analysis concepts. However, the complexity of the decisions involved, the large number of options to be considered and the requirement for speed in decision making justify the need for a new approach.

New methods have been developed that are quite different from previous approaches in that the design starts from the existing network rather than the stream data.

The retrofit design proceeds one modification at a time from the existing network. In this way the designer can develop retrofit projects in full control with the number of network changes kept to a minimum. Problems with multiple utilities are also addressed. The use of heat transfer enhancement techniques for increased heat transfer area on existing units can also be considered. The methods have been tested on a number of large industrial problems.

Process modifications can be considered simultaneously with heat exchanger network modifications. This allows increases in the performance of heat exchanger networks with fewer network structural changes.