

Research topics

Plate-Fin Heat Exchanger Systems

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Abstract

Heat transfer operations can be intensified through the use of compact heat exchangers. In particular, plate-fin heat exchangers offer many advantages over conventional designs. True counter-flow allows temperature differences as low as 1oC. Also, the volume required is of the order of one quarter that required for conventional heat exchanger designs. This project has developed the first truly systematic methods for the design and optimisation of heat exchanger networks involving plate-fin heat exchangers.

Project description

Compact heat exchangers, such as plate-fin multi-stream devices, are well established in some sectors of the process industries. However, their application has been largely restricted to low temperature (sub-ambient) processes. Plate-fin multi-stream heat exchangers offer many advantages over conventional designs. True counter-flow allows temperature differences as low as 1oC. Also, the volume required is of the order of one quarter that required for conventional heat exchanger designs.

When using multi-stream plate fin heat exchangers, the overall problem has two broad aspects. First is the design of the plate-fin heat exchanger itself. We must decide which type of fin we will use for the surface, the dimensions of the heat exchanger, its volume and its pressure drop. This is in itself a challenging problem. Second, we need to determine the heat exchanger network design. We must decide on the number of units, the intermediate headers, stream matching arrangements, the total volume and the total pressure drop. This is also a challenging problem. What is even more challenging is that these two aspects interact strongly with each other. No systematic methods are currently available for the design of heat exchanger networks involving plate-fin multi-stream heat exchangers.

This project has developed the first truly systematic methods for the design and optimisation of heat exchanger networks involving plate-fin multi-stream heat exchangers. The design procedures have been automated.

The procedures have been tested on a number of industrial problems and found to bring significant reductions in the volume of the equipment (volumes typically halved), together with a significant reduction in the complexity of the design.