

HEN Explorer

For optimisation of heat exchanger networks (HENs)
in retrofit and new design

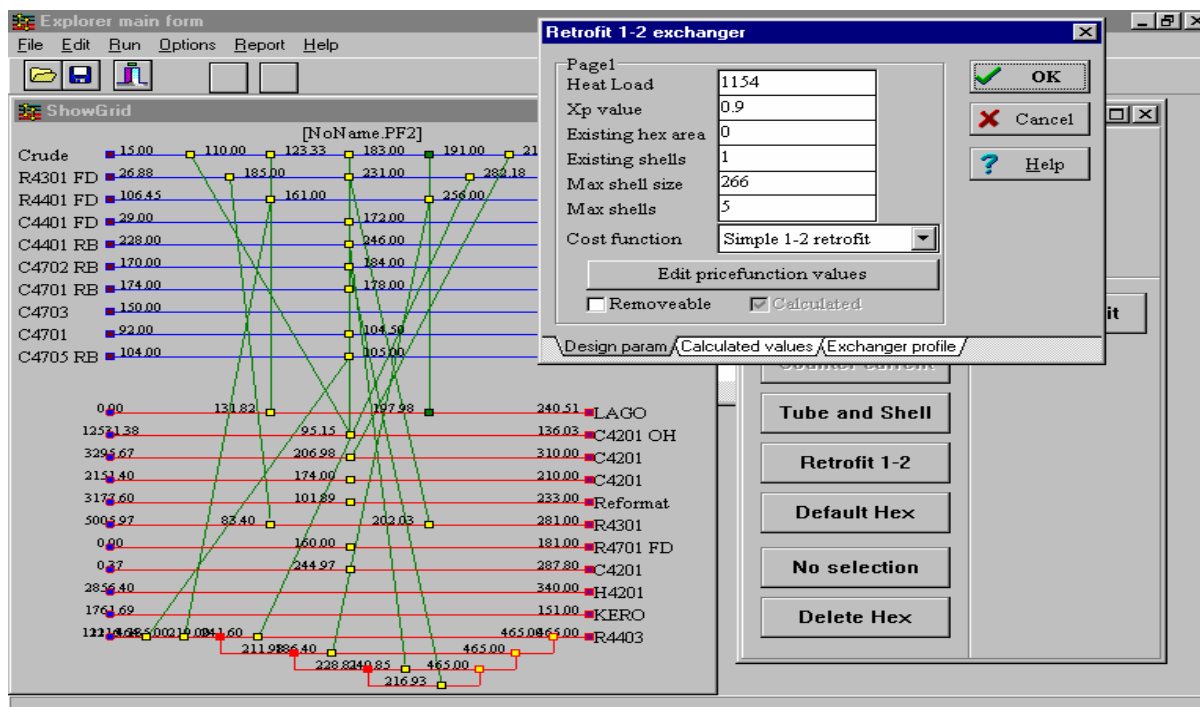


Targeting versus design

Pinch analysis has - and still is - widely used when it comes to screening and scooping among alternative process designs. When it comes to detailed design, methods, based on targeting approaches, face difficulties for including specific often non-thermodynamic considerations.

Therefore, it is important to notice the difference between "targeting methods" and "detailed design methods".

Typically, targeting methods need being transparent to the user possibly on the cost of precise description of the problem. Among others, targeting methods rely on overall cost estimations. On the other hand, detail optimisation methods should be able to include as much as possible of relevant detailed information to make a proper trade-off, while the transparency in the optimisation process is less important.



Mathematical methods

Optimisation techniques became available in the eighties and nineties for various purposes. In the most popular spreadsheets optimisation modules are included. These modules work fine with "wellbehaved" problems, but for large-scale optimisation problems, such as the heat exchanger network design problem, these methods are insufficient. Therefore dedicated algorithms must be applied. In HEN Explorer the "Simulated Annealing" (SA) algorithm is used. This algorithm is a very reliable optimisation method, which especially is useful for complex problems.

Detailed trade-offs

In the industry, the investment cost for heat exchanger network is not solely a function of energy use and heat exchanger areas. Issues like piping, pipe tracing, pressure drops and operability are key parameters which in many cases overshadows the investment of the core heat exchanger. Consequently, it is important to include these aspects in the optimisation objective function. In HEN Explorer several models are available for applying piping costs, restricting matches, restricting pressure drops etc.

User interactions

As the optimisation method can handle nearly all major cost elements and user restrictions, the major challenge for the user is to supply the correct parameters. HEN Explorer investigates a wide range of solutions and for each one calculates the total cost associated. The program ends up with several alternatives all being attractive solutions regarding total cost.

The user can afterwards evaluate the flock of attractive solutions having different designs. Often the results encourage the user to refine the problem parameters narrowing the uncertainties.

Industrial use

HEN Explorer has so far been used for internal use only. The software has been used successfully in several industrial studies including refineries (Statoil, Q8, Shell), fertiliser plants (Kemira) and various other plants processing (sugar, food, chemicals).



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