Mixed-Integer Nonlinear Programming Models for Optimal Simultaneous Synthesis of Heat Exchangers Network

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Problem Statement

The optimal design of Heat Exchanger Networks can be stated as follows:

> *Given a set of hot process streams $i \in HP$, which should be cooled from its inlet temperature $\left(T_i^{in}\right)$ to its outlet temperature $\left(T_i^{out}\right)$; a set of cold process streams $j \in CP$, which should be heated from its inlet temperature $\left(T_j^{in}\right)$ to its outlet temperature $\left(T_j^{out}\right)$; the heat capacity flow rates of the hot $\left(F_i^H\right)$ and cold process streams $\left(F_j^C\right)$; the utilities available (e.g., hot utilities HU and cold utilities CU) and their corresponding temperatures ($T_{CU}^{in}, T_{CU}^{out}$ and $T_{HU}^{in}, T_{HU}^{out}$) and costs ($c_{CU}$ and c_{HU}); Also given are the heat transfer coefficients for the hot streams h_i, for the cold streams h_j, and for the hot and cold utilities (h_{CU} and h_{HU}). Moreover, given are the fixed cost charge for each heat exchanger c_f and the coefficients α and β in order to calculate the cost of each heat exchanger according to its areas $\left(\alpha A^{\beta}\right)$. Given a staged superstructure as described in Yee and Grossmann (1990), the problem consists in finding the heat exchanger network with minimum annualized investment and operating costs, i.e. minimum Total Annualized Cost (TAC), by choosing the number of heat exchanger $\left(n_U\right)$ and its respective areas (A), and the utility consumption levels $q_{CU,i}$ and $q_{HU,j}$.*

Reference

1. *T. F. Yee, I. E. Grossmann, "Simultaneous Optimization Models for Heat Integration-II. Heat Exchanger Network Synthesis," Computers Chem. Eng., 1990, 14(10), 1165-1184.*