A HYBRID META-HEURISTIC APPROACH FOR MULTI-OBJECTIVE OPTIMIZATION OF HEAT EXCHANGER NETWORKS CONSIDERING COSTS AND ENVIRONMENTAL IMPACTS

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Abstract

Heat Exchanger Networks (HEN) are able to reduce hugely the capital and operating costs in an industrial plant. Cost-optimal HEN generally lead also to a substantial reduction in pollutant gases emissions. However, HEN synthesis approaches are based generally on the optimization of total annual costs (TAC) only. In that manner, this work aims to address environmental impacts (EI) more directly. The EI were converted into an objective function by using a Life Cycle Assessment (LCA) methodology. With two objective functions (EI and TAC), a multi-objective optimization (MOO) may be performed. A meta-heuristic approach is adapted to handle MOO on the formulation proposed. As expected, a conflictive behavior was noticed. The approach proposed was able to yield Pareto fronts efficiently, providing good intermediate solutions that could be used by decision-makers in search of a trade-off HEN configuration which is able to present low costs and be also environmentally friendly. The results reported in the case study also demonstrate the method reliability with intermediate solutions which are much more environmentally friendly than the cost optimal configurations, presenting costs only marginally higher.