World Academy of Science, Engineering and Technology
International Journal of Energy and Power Engineering
Vol:15, No:12, 2021

A General Iterative Nonlinear Programming Method to Synthesize Heat Exchanger Network

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Abstract : The work provides an iterative nonlinear programming method to synthesize a heat exchanger network by manipulating the trade-offs between the heat load of process heat exchangers (HEs) and utilities. We consider for the synthesis problem two cases, the first one without fixed cost for HEs, and the second one with fixed cost. For the no fixed cost problem, the nonlinear programming (NLP) model with all the potential HEs is optimized to obtain the global optimum. For the case with fixed cost, the NLP model is iterated through adding/removing HEs. The method was applied in five case studies and illustrated quite well effectiveness. Among which, the approach reaches the lowest TAC (2,904,026$/year) compared with the best record for the famous Aromatic plants problem. It also locates a slightly better design than records in literature for a 10 streams case without fixed cost with only 1/9 computational time. Moreover, compared to the traditional mixed-integer nonlinear programming approach, the iterative NLP method opens a possibility to consider constraints (such as controllability or dynamic performances) that require knowing the structure of the network to be calculated.

Keywords : heat exchanger network, synthesis, NLP, optimization
Conference Title : ICEEE 2021 : International Conference on Energy Efficiency and Engineering
Conference Location : London, United Kingdom
Conference Dates : December 09-10, 2021