Synthesis of multi-period heat exchanger networks incorporating enhanced heat transfer techniques

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Abstract

Process hot and cold stream parameters in chemical processes and allied plants do change from time to time due to issues such as changes in environmental conditions, plant start-ups/shut-downs, changes in product quality demand or changes in feedstock quality supply, etc. These changes, which may be predictable or unpredictable, need to be catered for in the design of heat exchanger networks in a cost optimal and environment friendly manner. This paper presents an extension to existing methods in the literature for synthesizing multi-period heat exchanger networks by designing networks that make provision for periodic storage of heat for use in succeeding periods of operations. The first and second steps of the approach adopted in this paper entails synthesizing optimal networks for the individual periods of operations involved in the problem, so as to identify the potential amount of heat available for storage in each period. The identified heat is then included as a hot utility in succeeding periods of operations. In the next step, a sequential approach is adopted to ensure that optimally sized representative heat exchangers that would feasibly transfer heat, irrespective of the period of operation involved, and in the light of the stored heat, are designed for the final multi-period network. The proposed approach is applied to an example problem and the results obtained demonstrate the benefit of the technique.