

Kanokkan Boontom 2011: A Novel Systematic Approach to Synthesize of Flexible Heat and Mass Exchanger Networks. Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Associate Professor Thongchai Srinophakun, Ph.D. 138 pages.

In this research, flexible heat exchanger networks (HENs), mass exchanger networks (MENs), and combined heat and mass exchanger networks (CHAMENs) are focused. The mixed-integer nonlinear programming (MINLP) synthesis combining with nonlinear programming (NLP) feasibility test as a single optimization problem is presented. Furthermore, an optimal control design consisting of five steps is also proposed. The steps are 1) the optimal configuration is generated with a minimum total annual cost (TAC) and minimum slack variables, 2) the optimal configuration is simulated in Aspen Plus to guarantee the optimal target of networks, 3) the active constraint regions are formulated, 4) the optimal split-range control structure is determined by integer linear program (ILP) and 5) the control structure is dynamically tested. Five case studies are illustrated. Case study 1 from Thunyawart (2010) is the heat integration system with 7 process streams. Sweetening of COG process from El-Halwagi and Manousiouthakis (1989) is proposed as case study 2. Case study 3 from Fieg *et al.* (2009) is the large scale heat integration system with 15 process streams. Case study 4 is the sweetening of COG process with external utilities. In this case, hot and cold utilities are added to the process. Sweetening of COG process with simultaneous heat integration is shown in case study 5 where the heat integration system of case 1 is combined with the COG process of case 2. From the results, the proposed approach can obtain the lower total annual cost of the optimal configuration compared with literatures. For dynamics tests, all cases have the control performance structure to maintain all targets of network at the desired values.

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