Recent Advances in Process Integration and Its Applications

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This special issue is dedicated to the Process Integration (PI) Forum held on 28 May 2017 in Taipei. The theme of this special issue is “Recent Advances in Process Integration and Its Applications.” A call for papers for the special section was announced after the event, on 13 July 2017. A total of five papers were accepted for publication after the peer review process. These papers come from outstanding research groups in Asia (India, China, Philippines and Taiwan) and Africa (South Africa), covering resource conservation and carbon management problems. A brief review of these papers is as follows.

Heat Exchanger Network Design and Retrofit

Isafiade (2018) presents a new synthesis method for retrofitting heat exchanger networks (HENs) using a two-step procedure. Firstly, the stream data are extracted and the grass-root design problem is solved using the stage-wise superstructure model. The resulting matches in the first step and the existing units in the original HEN are used to initialise a reduced superstructure in the second step. A key benefit of this synthesis approach is that the reduced superstructure makes the model less computationally expensive.

Kang and Liu (2018) develop a three-step method for the design of flexible multi-period HENs. In their method, a nominal multi-period HEN is synthesised first through the representative sub-period method. Next, the flexibility index of the

nominal multi-period HEN in each sub-period is analysed to identify the bottlenecks for HEN flexibility. A sub-period debottlenecking model is then solved to finalise the design of a flexible multi-period HEN.

Heat-Integrated Water Network Synthesis

Cheng and Adi (2018) develop a superstructure-based nonlinear programming (NLP) model for the design of non-isothermal water networks with the placement of regeneration units and heat exchangers. Different from the previous works, the heat exchanger model proposed in their work consists of cooling and heating sides for better flexibility. The overall model is solved simultaneously to determine the cost-optimal network configuration.

Resource Conservation and Other Application Variants

Jain and Bandyopadhyay (2018) address cost optimality of the segregated targeting problem with dedicated sources. A mathematically rigorous methodology is developed in their work, with an identified quantity setting the preference for the distribution of flows between different sources and demands. Their methodology has been applied to carbon-constrained energy sector planning, water allocation network synthesis and resource conservation in an integrated iron and steel mill.

Tan et al. (2018) propose a graphical pinch analysis approach to planning biochar-based carbon management networks (CMNs). Biochar is a potentially scalable negative emission technology. Scaling up biochar-based systems requires the planning of a CMN consisting of biochar sources (i.e. production facilities) and biochar sinks (i.e. receiving tracts of land). In general, such CMNs should be operated to maximise system-wide carbon sequestration without causing adverse environmental effects.

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