Abstract

In the chemical process, the production index, such as quality and quantity of the products always changes along with the requirements of the market. During the adjustment, corresponding set points of the temperature or composition controllers are always adjusted to achieve production goals, meanwhile, it is important to achieve the optimal utilization of the energy. Strong anti-interference ability and short adjustment period can ensure the robustness of the controller and production index, which are very significant for the design of the control system. Therefore, the investigation on the control strategy is essential, which can not only improve of the production index, but also achieve more energy saving.

For instance, there is a simple two-inputs-two-outputs system, in which the coupling always exists between these two inputs and outputs, and the adjustment of one input will directly affects two outputs. The proper process control and coordination strategy can efficiently solve the control of the inputs and acquire more products in limited energy, when one of the key output varies along with the requirement. To solve the control problem of improving the quality of the key output, this paper investigates three kinds of control strategies, both flow rate setting control, both temperature or composition control, and combination of the temperature or composition control and flow rate setting control. For the ordered objective key output composition, the accurate flow rates of two inputs are unknown, so it is impossible to give out set points on two flow rate setting controllers, further more to improve the quality of the products. In the second control strategy, according to the new expected output, the set point of temperature and composition can be changed directly by requirements to calculate the corresponding input. Proposing that the key input can be developed by the key controller, while the other expected output is unknown and the original set point of controller is not the optimal value under the new condition of the key output. Based on the third control strategy, the objective output can be controlled, and input can be developed by controller. The other input can be adjusted to achieve the optimal energy-saving goal by the coordination optimisation, and treated as the set point of the setting controller. The change of the new set point of the setting controller can drive the composition or temperature controller to develop a new output to keep the set point constant.
A case study on the multi-feed demethaniser in ethylene complex to achieve the overhead production index control is employed to identify the efficiency of the control strategy proposed in this paper. It turns out that the combination of the process control and coordination, which includes the control of the objective overhead composition and flow rate setting control at the bottom reboiler, is more efficient for the improvement of the product quality and energy saving.