HYBRID INTELLIGENT OPTIMAL-SETTING CONTROL WITH MULTI-OBJECTIVES OF THE RAW SLURRY BLENDING PROCESS IN THE ALUMINA PRODUCTION

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Abstract. Raw slurry blending process is one of the key producing processes in the sintering alumina production. Key technical indices of this blending process are the quality indices of the raw slurry and the load state of the mill. Operation control objectives are to control the quality indices into their targeted ranges and control the load state of the mill in the good state. However, due to the difficulty of measuring the quality indices and the load state on-line, and the complex dynamical characteristics between the technical indices and the control loops, these control objectives are difficult to be realized by using the existing control methods. A hybrid intelligent optimal-setting control of the raw slurry blending process is proposed. The proposed optimal-setting control with the hybrid intelligent approaches can automatically adjust the set-points in order to respond to the variation of the boundary condition. At last, the proposed control approach is applied in an alumina factory in China, and the application results have proven the validity and effectiveness of the proposed methods.

Keywords: Raw slurry blending process, Optimal-setting control, Quality indices, Mill load, Hybrid intelligent control

1. Introduction. Key technical indices of the industrial processes often represent the product quality, energy consumption, production efficiency, and so on [1]. Controlling these key technical indices with the satisfactory performance can make enterprises obtain the higher net return. From a process engineering point of view, the purpose of automatic control of the industrial processes is not only primarily to control the controlled variables in the control loops at their set-points as well as possible but also to control these key technical indices [1-4].

In recent years, optimal control for operation of the industrial process, whose control objectives are to control the technical indices, has attracted more and more researches in the academia and industry. In the optimal operation control, how to dynamically determine the appropriate set-points of control loops on-line is the key problem. Now, optimal operation control mainly includes the self-optimizing control [5,6], the real-time optimization (RTO) [7], the direct finite horizon optimizing control [8], and so on. There are some shortcomings in these existing methods mentioned above:

(1) Accurate process models are necessary [1,9]. However, it is difficult to obtain the accurate models of some complex industrial processes.