

A NEW DESIGN METHOD FOR ENERGY SAVING AND CONSUMPTION REDUCING OF PROCESS INDUSTRY BASED ON EXTENSION THEORY

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ABSTRACT. *Energy saving and consumption reducing in process industry have recently become an urgent issue with common concern. Under the certainty of production device and technical condition, a reasonable and effective design scheme for operation conditions becomes the key part in reducing the consumption of energy and material. In actual production process, the operating variables are massive and the relation among them is complex, so that traditional design methods based on practice experience or case-based reasoning (CBR) technology have not met the demand. In the paper, a new intelligent design method based on extension theory is proposed, in which matter-element model is used to the deep design representation, rhombus thinking method is applied to the reasoning and analyzing in the design process including design transformation and design evaluation. Through the actual application in purified terephthalic acid (PTA) solvent system of a chemical plant, cases studies and comparison show that the proposed method uniformly presents the matter, formally describes the human thinking, and successfully provides the design scheme for operating conditions, which solves the contradiction between design goal and design conditions, gives the decision-making support for operation regulation, brings economic profit for enterprise, thus exploits a new and efficient way to the scheme design for energy saving and consumption reducing in process industry.*

Keywords: Extension theory, Scheme design, Energy saving and consumption reducing, PTA solvent system

1. Introduction. With the continual expansion of production scale, energy saving and consumption reducing have become the foremost problem to be solved in the process industry. Under the certainty of production device and technical condition, energy consumption and material waste are directly interrelated with operation conditions of production process. Thus, design for operation regulation has become the crucial link.

Most commonly, practice experience or case-based reasoning (CBR) technology [1,2] is used in the scheme design. For the former one, it lacks objectivity and is often subjected to the complexity of problem itself. For the latter one, it draws similar examples from the case base to provide references to new design requirements. However, it is lack of uniform case representation and problem description combining quantitative analysis with qualitative analysis. Moreover, the ability to adaptability revision is not ideal, which causes negative impact on the ability of CBR system. Thereby, they can not wholly solve the contradiction between design goal and design conditions.

Considering extension theory [3,4], it provides the integral theoretical system and practical method for solving the contradiction problems, which applies the formal model to expand the possibility of matter and explore the innovative principle. In these years, it