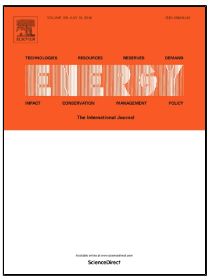
Accepted Manuscript



Coordination between bypass control and economic optimization for heat exchanger network

Lin Sun, Xinlang Zha, Xionglin Luo

PII:	S0360-5442(18)31316-1
DOI:	10.1016/j.energy.2018.07.021
Reference:	EGY 13286
To appear in:	*Energy*
Received Date:	16 January 2018
Accepted Date:	06 July 2018

Please cite this article as: Lin Sun, Xinlang Zha, Xionglin Luo, Coordination between bypass control and economic optimization for heat exchanger network, *Energy* (2018), doi: 10.1016/j.energy.2018.07.021

Coordination between bypass control and economic optimization for heat exchanger network *

Lin Sun *, Xinlang Zha and Xionglin Luo,

Research Institute of Automation, China University of Petroleum, Beijing 102249, China

ABSTRACT: The bypass is widely used for optimizing the operation of heat exchanger network (HEN) to maintain the control requirements. More attention on the bypass control strategy has been paid to the control performance without considering the economics. However, the economic efficiency is quite important to the industry with energy intensive production as energy prices to rise. Therefore, both the control performance and the economic efficiency should be considered simultaneously during the life cycle of HEN. In this work, firstly we proposed a methodology for two-stage coordination of bypass control and economic optimization (CBCEO). Then the one-step coordination between bypass control and economic optimization is developed based on two-stage CBCEO. Secondly, the margin of HEN is commonly optimized and can be calculated by the variation of bypass fractions, which is regarded as the objective function in this work. Then non-square relative gain array is utilized to obtain optimization variables and the optimal control structure is established. Thirdly, an optimization algorithm combining external penalty function with pattern search is used to solve this dynamic optimization problem (DOP). Finally, two case studies indicated that the proposed CBCEO strategy can achieve the purpose of effective control and optimal economic at the same time.

Key words: heat exchanger network; bypass control; optimization; coordination; margin

1. Introduction

Recently, increasing attention has been paid to industry with energy intensive production [1]. At the same time, nearly 80 % of the total energy consumption is related to the heat transfer [2]. Therefore, the optimal control is essential to the improvement of the efficiency of energy utilization and eliminating the energy losses.

The control problem of heat exchanger network is considerable difficulty because of its non-linear behavior and complexity which caused by many phenomena such as leakage, friction, temperature dependent flow properties, contact resistance, unknown fluid properties [3-4]. Quite a number of control strategies that overcome some of the above problems have been put forward. Skorospeshkin et al. [5] suggested an adaptive control system for a hydrocarbon perspiration temperature control and high effectiveness is shown during changing control object parameters. In addition, Vasičkaninová [6-7], Bakošová [8], Oravec [9] have investigated a series of advanced control strategies for better set-point tracking and adequate disturbance rejection ability. In these studies, the control strategies of the HEN are mainly researched by using the flow rates of streams as the manipulated variables. However, the manipulation of the flow rate is most commonly used when that stream is a utility (cooling water, steam,

Received ***, accepted ***.
* Supported by the National Natural Science Foundation of China (NO. 21676295).
** Email address: sunlin@cup.edu.cn.