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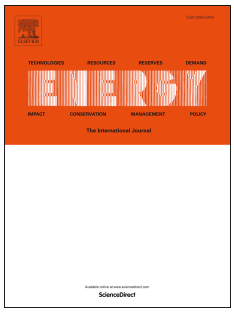

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PII: S0360-5442(18)30384-0

DOI: 10.1016/j.energy.2018.02.150

Reference: EGY 12450

To appear in: *Energy*

Received Date: 5 September 2017

Revised Date: 21 February 2018

Accepted Date: 26 February 2018

Please cite this article as: Zheng C, Chen X, Zhu L, Shi J, Simultaneous design of pump network and cooling tower allocations for cooling water system synthesis, *Energy* (2018), doi: 10.1016/j.energy.2018.02.150.

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Simultaneous Design of Pump Network and Cooling Tower Allocations for Cooling Water System Synthesis

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Abstract:

To avoid wasting resources and energy, a simultaneous design approach is proposed for process synthesis of cooling water system in this paper. For a cooling water system involving multiple supplies and cooling water using operations, an integrated optimization is presented in which the pump network, cooling water network and cooling tower are designed as a whole system. Mixed-integer nonlinear programming based on a superstructure description is formulated by considering the configuration of the main-auxiliary pump, the location of the cooling towers, and the supply mode of cooling water simultaneously. Four operational cases are presented and analyzed in detail for the integrated cooling water system design. In all cases, global optimality is achieved with zero integrality gap, thus indicating that the optimal location and load of each cooling tower along with the optimal configurations of the pump network and the cooling water network are obtained. Relaxation techniques for addressing the nonlinear terms in the model are also presented and good performance in computation speed can be achieved.

Keywords: Cooling water system; Integrated design; Pump network; Superstructure.

1. Introduction

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