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Project Title:

Optimum Design of Cooling Water Systems for Energy and Water Conservation

Abstract:

Re-circulating cooling water systems (RCWSs) are widely used to reject waste process heat to the environment, conserve fresh water and reduce thermal pollution relative to once-through systems. Research on RCWS has mostly focused on individual components, cooling tower and heat-exchanger network. Kim and Smith [Kim, J.K. and Smith, R., 2001, Cooling water system design, Chem Eng Sci, 56(12): 3641–3658] developed a grass-root design method of RCWS(KSD). In this paper, the KSD method is expanded and a comprehensive simulation model of RCWS is developed accounting for interaction between cooling tower and heat-exchanger network. Regarding this model, a modern grass-root design method of RCWS, we call it Advanced Pinch Design (APD), based on combined pinch technology and mathematical programming is developed for minimum cost achievement. Having considered cycle-water quality through introducing ozone treatment technology, APD methodology is further improved. This technique that we call Enhanced Cooling Water System Design (ECWSD), as the APD supplementary methodology, is provided water and energy conservation, minimum cost and environmental impacts. Related coding in MATLAB version 7.1 is developed for the illustrative example to get optimal values in RCWS design method computations. Finally the results of the introduced grass-root design methodologies, APD and ECWSD, are compared with KSD.