Imperialist Competitive Algorithm to Optimize the Heat Transfer in Air Cooler Equipped with Butterfly Inserts

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Abstract

In this paper the use of a novel optimization algorithm based on imperialist competitive algorithm (ICA) for optimizing the heat transfer in an air cooled heat exchanger equipped with the butterfly inserts has been reported. This method is one of the evolutionary algorithms used in optimization of engineering fields. Simplicity, accuracy and time saving are some of the advantages of this method. Experiments included the inclined angle of the butterfly inserts ranging from 45^{o} to 135^{o}. Also, the Reynolds number varied from 4021 to 16118. After data reduction, the regression equation of average Nusselt number was obtained as a function of Reynolds number and the inclined angle. Then the cost function was optimized by the use of ICA. One can be sure that the Nusselt number will be optimized due to the optimization of the cost function. Computational results indicate that the proposed optimization algorithm is quite effective and powerful in optimizing the cost function. According to the results, in order to obtain maximum heat transfer, the inclined angle must be 87^{o}. This means that, by the deviation of inclined angle of butterfly inserts from 45^{0}, heat transfer decreases. This can be due to the generation of stronger turbulence intensity and more rapid mixing of flow created by this insert.

Keywords: Air cooled heat exchanger, Heat transfer, butterfly inserts, Optimization, Imperialist competitive algorithm (ICA).

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