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Effect of partially wet-surface condition on the performance of fin-tube heat exchanger
(2019) *International Journal of Numerical Methods for Heat and Fluid Flow*, . Cited 1 time.

Abstract
Purpose: This study aims to investigate heat and mass transfer in a one-row heat exchanger. The required equations are obtained based on two-dimensional model analysis in a cell of the heat exchanger. By using finite difference approach, the obtained equations are solved to determine distribution of temperature and the efficiency of the heat exchanger in the case of partially wet surface. In this research, Lewis Number as unity and water vapor saturation as parabolic are assumed. Obtained results show that increase in thermal conductivity fin leads to decreasing thermal resistance; therefore, temperature changes in radial from center to out of fin are reduced and efficiency of fin increases. Design/methodology/approach: In this regard, fin material plays a significant role in fin efficiency. Changes in airflow also result in an efficiency increase by temperature and relative humidity, and efficiency is decreased by airflow velocity increase, and these changes are almost linear. Moreover, the fins with more wet surface are more sensitive to changes in fin dimensions and air flow characteristics, and it is a result of conjugate heat transfer mechanism, in which latent heat transfer in the fins with more wet surface has a significant role. Findings: Thermal property and geometry of the fin under wet conditions play a more important role than the fin under dry conditions. Changes in airflow result in an efficiency increase by temperature and relative humidity, and efficiency is decreased by airflow velocity increase, and these changes are almost linear. Fins with more wet surface are more sensitive to changes in fin dimensions and air flow characteristics. Originality/value: Effects of the temperature of water supply and mass flow rate were considered in the study. The results had good agreement with actual data. © 2019, Emerald Publishing Limited.

2-s2.0-85065792191
Document Type: Article
Publication Stage: Article in Press
Source: Scopus