Invited Speaker : Prof. Dr. Somchai Wongwises
Actual Dry-Bulb Temperature Method for Fin-and-Tube Heat Exchangers under Dehumidifying Conditions

Abstract

Recently, the performance of fin-and-tube heat exchangers under dehumidifying conditions can be evaluated by the lumped approach model. It is based on the enthalpy potential or equivalent dry-bulb temperature. This study proposes a new lumped approach model based on the actual dry-bulb temperature. The concept of actual dry-bulb temperature was first presented by McQuiston for derivation of fin efficiency under dehumidifying condition in 1975. This concept is simpler than the concepts of enthalpy potential and equivalent dry-bulb temperature. Nevertheless, it cannot be found that this concept is applied to the fin-and-tube heat exchangers. Moreover, this study also presents the finite circular fin method (FCFM) based on the dry bulb temperature. The FCFM was first presented in our published literature but it was based on the enthalpy potential. The FCFM is done by dividing the fin-and-tube heat exchanger into many small segments. Then, the segments are divided into three cases: fully dry condition, fully wet condition, and partially wet condition. From the results, the heat and mass transfer characteristics obtained by the FCFM based on actual dry-bulb temperature are lower than those obtained by the FCFM based on equivalent dry-bulb temperature and those obtained by the FCFM based on enthalpy potential. This is because of the effect of the non-constant term in the two methods.

Keywords: Actual dry-bulb temperature, Finite circular fin method, Fin-and-tube heat exchanger.