

An Analytical and Numerical Solutions for the Thermal Analysis of a Mechanical Draft Wet Cooling Tower

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Abstract : The thermal analysis of the mechanical draft wet cooling tower is performed in this study by the heat and mass transfer modelization in the packing zone. After combining the heat and mass transfer laws, the mass and energy balances and by involving the Merkel assumptions; firstly, an ordinary differential equations system is derived and solved numerically by the Runge-Kutta method to determine the water and air temperatures, the humidity, and also other properties variation along the packing zone. Secondly, by making some linear assumptions for the air saturation curve, an analytical solution is formed, which is developed for the air washer calculation, but in this study, it is applied for the cooling tower to express also the previous parameters mathematically as a function of the packing height. Finally, a good agreement with experimental data is achieved by both solutions, but the numerical one seems to be the more accurate for modeling the heat and mass transfer process in the wet cooling tower.

Keywords : evaporative cooling, cooling tower, air washer, humidification, moist air, heat, and mass transfer

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