Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Numerical analysis of heat and mass transfer for water recovery in an evaporative cooling tower HYUNSUB LEE, GIHUN SON, Department of Mechanical Engineering, Sogang University — Numerical analysis is performed for water recovery in an evaporative cooling tower using a condensing heat exchanger, which consists of a humid air channel and an ambient dry air channel. The humid air including water vapor produced in an evaporative cooling tower is cooled by the ambient dry air so that the water vapor is condensed and recovered to the liquid water. The conservation equations of mass, momentum, energy and vapor concentration in each fluid region and the energy equation in a solid region are simultaneously solved with the heat and mass transfer boundary conditions coupled to the effect of condensation on the channel surface of humid air. The present computation demonstrates the condensed water film distribution on the humid air channel, which is caused by the vapor mass transfer between the humid air and the colder water film surface, which is coupled to the indirect heat exchange with the ambient air. Computations are carried out to predict water recovery rate in parallel, counter and cross-flow type heat exchangers. The effects of air flow rate and channel interval on the water recovery rate are quantified.

Hyunsub Lee
Department of Mechanical Engineering, Sogang University, Seoul 04107

Date submitted: 27 Jul 2017 Electronic form version 1.4