Abstract

In this research an experimental and numerical analysis have been conducted for temperature and velocity distribution in space conditioned with corrugated ceiling radiant cooling panels (RCP).

The experiments were made on a model room with dimensions of (1m×0.8m×0.6m) that was built according to a suitable scale factor of (1/5) to simulate the temperature distribution by fixing 36 thermocouples in array scheme in three different zones and heights. Two cases were considered in this work that classified according to convection heat transfer scheme added to the radiation heat transfer, the first one with natural convection (NC) only and the second one with mixed convection (MC) (natural and forced convection) heat transfer. The main variable in the experiments was the mean panel temperature (T_{mp}) and was given values of (15, 16 and 17^{o}C), T_{mp} shouldn't be lower than that range to avoid the risk of condensation of water vapor on the tubes and panel surface.

The experimental forced convection (FC) cases were taken with an air inlet temperature of 24^{o}C and velocity of 0.7m/s with a range of outdoor air temperature of (36 to 42^{o}C). The results showed the enhancement that has been occurred on total cooling capacity and on the MC heat transfer coefficient.

The numerical analysis was carried out by the Ansys Fluent 13 program, and the cases considered several parameters that are; mean panel temperature, outdoor air temperature, air inlet temperature and velocity. Most of the computed result were presented as temperature contours and velocity vectors diagrams and compared with the experimental work and these comparisons showed a fairly good agreement. Both experimental and numerical studies assist the use of RCP for cooling purposes in Iraqi climate for its ease, simple and good comfort performance.