

### ABSTRACT

A theoretical study includes details flow turbulence in air-conditioned spaces with the determination of the boundary conditions depending on the Iraqi Code of cooling is done in this research.

Two kinds of two-dimensional and three-dimensional ventilation problems have been considered:

- (a) isothermal ventilation in simple rooms.
- (b) non-isothermal ventilation with coupled heat or mass transfer.

The investigation has studied the flow and thermal boundary conditions for four different diffusers (displacement, grille, slot, and square diffusers). The dimensions of the physical model are (5.16×3.65 m) with (2.43 m high). The supply condition for four diffusers are (displacement (0.0768 kg/s), grille (0.0768 kg/s), slot (0.1410kg/s), square (0.750kg/s)) and temperature at supply for all types is (15.0°C), the return considered as the type of diffusers has been imposed zero flow pressure and temperature at (24.0°C).

A modified version of a three-dimensional computer program (fluent 6.3.26) by using finite-volume method was used to simulate the complex flow with buoyant inside the model room. They have been investigated numerically by using several turbulence models and the method solution by using k- $\epsilon$  and k- $\omega$  models.

The numerical results can be divided into:

- 1- Results which compared with the measured ones obtained from ASHRAE RP-1009 three-dimensional as non-Isothermal and two cases of two-dimensional as Isothermal.
- 2- There is a good agreement with (k- $\omega$ ) model gives more accurate fitting and closer to reality, the reason for this is due to the overall average error for displacement ventilation (19.87 % at velocity curves) and (14.20 % at temperature curve).

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3- The Effective Draft Temperature (EDT) for four types of diffusers for three orientations simulating the Iraqi condition (east, south, west) for these models are as follow:

Type of outlet	k- $\epsilon$	k- $\omega$
Displacement	(0 – (-1.134))	(-0.93 – (-2.07))
Grille	(-0.451 – (-2.468))	(-1.261 – (-1.876))
Slot	(-1.1678 – (-6.41))	(-1.67 – (-4.659))
Square	(-0.789 – (-4.01))	(-0.622 – (-1.218))

The EDT performance of various commonly used turbulence models for complex airflows and temperature distributions with forced ventilation conditions for different buildings in Iraq, also obtain displacement outlet is better than other types. The accuracy of the results can be found at different levels in terms of average temperature.