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Effects of the Air Supply Outlets Geometry on Human Comfort inside Living Rooms: CFD vs. ADPI

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Abstract : The paper is devoted to numerically investigating the influence of the air supply outlets geometry on human comfort inside living looms. A computational fluid dynamics model is developed to examine the air flow characteristics of a room with different supply air diffusers. The work focuses on air flow patterns, thermal behavior in the room with few number of occupants. As an input to the full-scale 3-D room model, a 2-D air supply diffuser model that supplies direction and magnitude of air flow into the room is developed. Air distribution effect on thermal comfort parameters was investigated depending on changing the air supply diffusers type, angles and velocity. Air supply diffusers locations and numbers were also investigated. The pre-processor Gambit is used to create the geometric model with parametric features. Commercially available simulation software “Fluent 6.3” is incorporated to solve the differential equations governing the conservation of mass, three momentum and energy in the processing of air flow distribution. Turbulence effects of the flow are represented by the well-developed two equation turbulence model. In this work, the so-called standard k-ε turbulence model, one of the most widespread turbulence models for industrial applications, was utilized. Basic parameters included in this work are air dry bulb temperature, air velocity, relative humidity and turbulence parameters are used for numerical predictions of indoor air distribution and thermal comfort. The thermal comfort predictions through this work were based on ADPI (Air Diffusion Performance Index),the PMV (Predicted Mean Vote) model and the PPD (Percentage People Dissatisfied) model, the PMV and PPD were estimated using Fanger’s model.

Keywords : thermal comfort, Fanger's model, ADPI, energy effeciency
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