Evaluation of Sub-Zonal Airflow Models for the Prediction of Local Interior Boundary Conditions: Natural and Forced Convection Cases

Currently, researchers are striving to advance the possibilities to calculate the integrated phenomena of heat, air and moisture flows in buildings, with specific focus on the interactions between the building zones and building components. This paper presents an investigation of the capability and applicability of the sub-zonal airflow model to predict the local indoor environmental conditions and surface transfer coefficients near building components. Two test cases were analyzed for, respectively, natural and forced convection in a room. The simulation results predicted from the sub-zonal airflow models are compared to experimental data and numerical computational fluid dynamics (CFD) results. The study shows that sub-zonal models combined with an appropriate surface transfer coefficient model are able to give reliable predictions of the local indoor environmental conditions and surface transfer coefficients near the building component for the analyzed cases. The relatively short computation time and flexibility of the sub-zonal model makes the application attractive for transient simulation of heat, air and moisture transport in buildings. However, the availability of appropriate reference conditions, for example experimental or numerical results, is a prerequisite for the development of a reliable sub-zonal model.

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