Numerical computation study on ventilation panel models in a subway passenger compartment

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Abstract

The internal flow field profile (temperature distribution and velocity distribution) has a significant impact on the passenger comfort level. Experimental studies on internal flow field can yield accurate results but carry a high time，equipment and human resource cost. In contrast, numerical computation can yield an internal flow field profile in less cost. This study aims to improve the efficiency of numerical computation of internal flow field. In this manuscript, two simplified models of ventilation panel are adapted (the porous media model and the porous jump face model) for simulate the real ventilation panel of air-duct system in a subway head car. The experimental and computational measurement points were both set based on the settings of the European standard EN14750. The results provided by numerical computation with the simplified models have a good agreement with experimental data. The flow field parameters (temperature and velocity) of the simplified models have relatively small numerical errors, with a maximum numerical error of horizontal temperature difference about 4.09%. The difference of horizontal average temperature between the numerical results and the experimental data is less than 1%, and the difference of horizontal average velocity is 2.50%. By replacing the real ventilation panel with the two simplified models, the flow field of subway car compartments can be calculated within a lower cost, while maintaining good accuracy. Consequently, these simplified models result into a good choice for the simulation of the internal flow field within a subway car.

Keywords: Numerical computation, Ventilation panel model, Internal flow field, Subway passenger compartment