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Comparison study on air flow and particle dispersion in a typical room with floor, skirt boarding, and radiator heating systems

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Abstract

In the present study, air flow and particle dispersion were simulated in a room using a three dimensional model when a thermal manikin was present in the room. The room was tested with three heating systems: floor heating, skirt boarding heating, and radiator heating systems. Airflow velocity and temperature distributions were obtained in terms of room's height in different places of the room. Three particle sizes as well as two locations of particle injection were studied. An Eulerian-Lagrangian model was used to predict the characteristics of air and particle phases. In the Lagrangian particle model, the effects of drag, lift, thermophoretic, and Brownian forces were considered. Results showed that the skirt boarding heating system due to uniform heat distribution and lower heat losses as well as providing a better thermal comfort condition, has the best performance among all the studied heating systems. The results of particle phase showed that the skirt boarding heating system has the lowest particle concentration in the breathing zone of the manikin. Furthermore, it was shown that due to the presence of thermal sources in the room, the particles have a small tendency to leave the room and they mostly settled on walls and ceiling or stayed at lower heights of the room.

Keywords: Floor heating, Skirt boarding, Radiator, Breathing zone, Particle dispersion

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