

Development of Numerical Modeling Methods for the Improvement of Air Quality and Thermal Environment Inside and Outside Buildings

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The recipient of AIJ prize has demonstrated techniques for environmental improvement both inside and outside buildings based on numerical analysis models. In particular, the recipient developed three methods. (1) An air quality and thermal analysis model was developed to study both the indoor and outdoor environments. Then, evaluation methods were developed based on the spatial distributions of air velocity, temperature and concentration obtained through numerical simulation. In particular, the direct capture efficiency of local exhaust devices, the effective ventilated volume and the numerical modeling of air diffusers were investigated. (2) A heat budget model was developed to help mitigate heat island phenomena at the urban surface. Using this model, the recipient focused on the effects of the solar reflectivity of the urban surface on heat island phenomena. The results indicated that heat island phenomena can be mitigated by increasing the solar reflectance of roofs and pavements. (3) A mass diffusion model was developed to investigate diffusion within building materials. In particular, the diffusion processes of VOCs in porous media were modeled to predict indoor air quality. The diffusion of blowing agents in insulation foams was also modeled, and a method for the estimation of performance aging has been proposed.