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Behavior of Two-dimensional Jets Passing Over Flat Plate Row

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Extended Abstract

Since the Covid-19 epidemic, there has been growing interest in ventilation and air conditioning in enclosed spaces. Jetstream technology has been applied to the ventilation and air conditioning of most vehicle cabins [1]. Many researchers have studied jets and clarified their behavior near walls, which are the simplest boundary conditions for free jets. Foerthmann discussed the velocity distribution of a two-dimensional turbulent free jet and reported that the maximum velocity of the jet decreases and the jet width increases as it flows downstream [2]. Furthermore, Rajaraatnam reported the results of a study on jet spreading near a wall surface and showed that the half-width of a two-dimensional jet is approximately 0.7 times wider than that of a two-dimensional free jet [3]. Nishibe et al. conducted a fundamental study of the Coanda effect on the reattachment distance of synthetic jets near a wall surface [4]. However, although Ishiwata et al. [5] clarified the effect of geometry (partition plate length and cavity depth) on the flow characteristics of the recirculation region generated inside the cavity for jets passing through a row of flat plates, no systematic study has been conducted, and the jet deflection mechanism remains unclear. This study elucidates the behavior of jets passing over a row of flat plates. This situation can be regarded as a simple model of a room with furniture and partitions or a cabin seat in a high-speed train or airplane, and this work can be positioned as a fundamental study for improving the efficiency of air conditioning and ventilation. The study was conducted mainly through visualization experiments and numerical simulations. The main results show that the degree of jet deflection depends on the relative distance from the bottom of the jet outlet slot to the top of the partition plate when the plate spacing is relatively small, and on the relative distance from the bottom of the jet outlet slot to the bottom of the cavity when the plate spacing is extremely large.

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