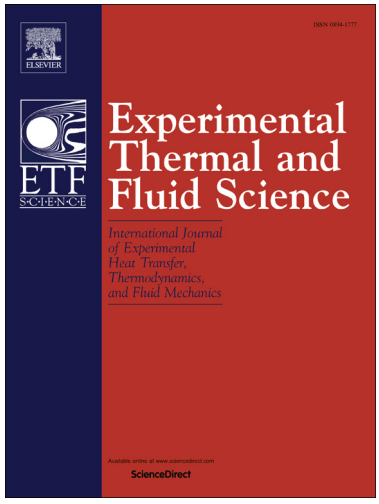

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Study on the near wake of a honeycomb disk

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Abstract: Flow around and/or through a honeycomb disk is a common problem encountered in aggregation, filtration and sedimentation processes. Mean flow, turbulent statistics and flow structures behind a solid and a honeycomb disk were experimentally studied by 2D PIV system. The results revealed that the mean flow structure behind a honeycomb disk was quite different from that of the solid disk wake. Due to the extra fluid through the small holes on the disk, the recirculation zone of honeycomb disk was much smaller both in length and in width. Meanwhile, the entrainment of the shear layer was significantly reduced and the length of the wake was increased. As the result, the honeycomb disk drastically decreased the velocity deficit, the rate of velocity recovery. The cross-stream distributions of Reynolds normal stresses exhibited symmetry while Reynolds shear stress showed asymmetry at x/d=1、3、5, respectively. Using proper orthogonal decomposition (POD), it was found that, for both solid and honeycomb disk, the instantaneous wake configuration at reflectional –symmetry -breaking (RSB) mode with hairpin vortices periodically shedding could be detected by the first two POD modes. The POD mode 3 consisted of two pairs of contours, showed well plane-symmetric large-scale vortices shedding from the mixing layers region (y=±0.5D. Due to different wake recovery rate and the interaction between the backflow and the shear layer, mode 4 structures in the both near wakes were obviously different.

Key words: bluff body wake; honeycomb; flow structure; recirculation region

1 Introduction

Applications of the bluff bodies have been investigated in various fields, such as chemical engineering, heat transfer enhancement, super-adiabatic combustion, et al[1,