2.The vortex generation and breaking processes in an impinging round jet*

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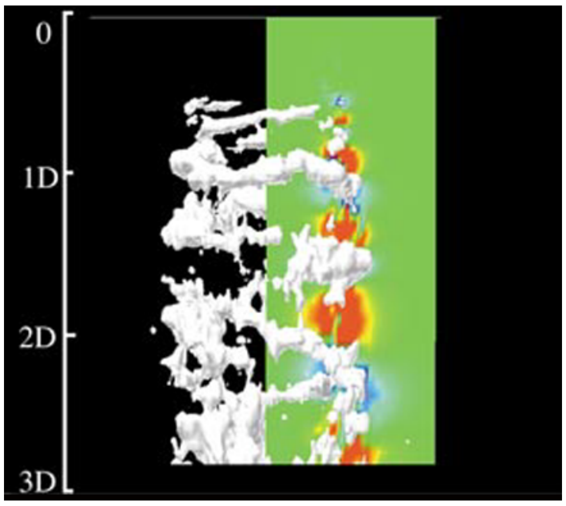
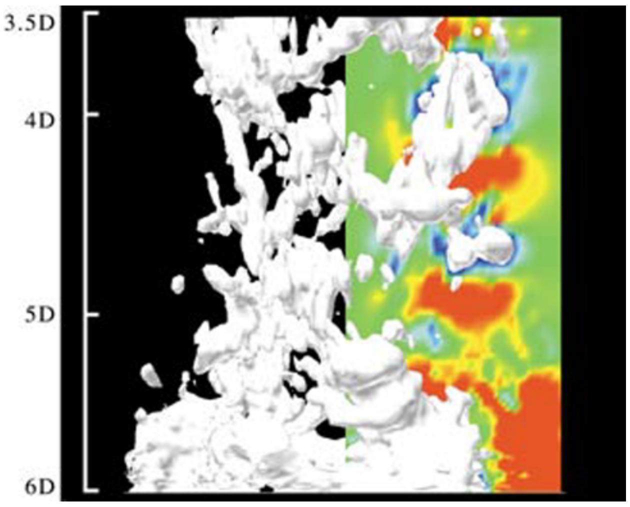


(a) The three-dimensional contour surface of the vortex in the near nozzle edge. White: vortical structures, red; high pressure region, blue: low pressure region, flow direction: top to bottom.



(b) The three-dimensional contour surface of the vortex in the impingement region. White: vortical structures, red; high pressure region, blue: low pressure region.

A direct numerical simulation (DNS) of an impinging round jet into parallel disks (the increment is 6 D) is performed for a Reynolds number of 10000 based on the nozzle exit velocity U_0 and the nozzle diameter (D). The generation of vortex-rings below the nozzle edge can be observed in Fig (a). Figure (b) shows the vortex breaking about half way between the nozzle and the wall. In the impingement region, it is found that the vortex-ring column disappears and another big torus-shaped low pressure region forms in the downstream region. The vortex generation and breaking processes and the generation and elongation processes of the wall-streaks will be considered as the main mechanism of turbulence transition in this flow.

* Satake, S. and Kunugi, T. (1998): Direct Numerical Simulation of an Impinging jet into parallel disks, Int. J. of Numerical methods for Heat & Fluid Flow, Vol. 8, No. 7, pp. 768-780.