Journal of Visualization, Vol. 8, No. 3 (2005) 199

Shear Layer Instability at Low Reynolds Numbers

Mittal, S. [1)]

1) Department of Aerospace Engineering, Indian Institute of Technology Kanpur, UP 208 016, India.
E-mail: smittal@iitk.ac.in.

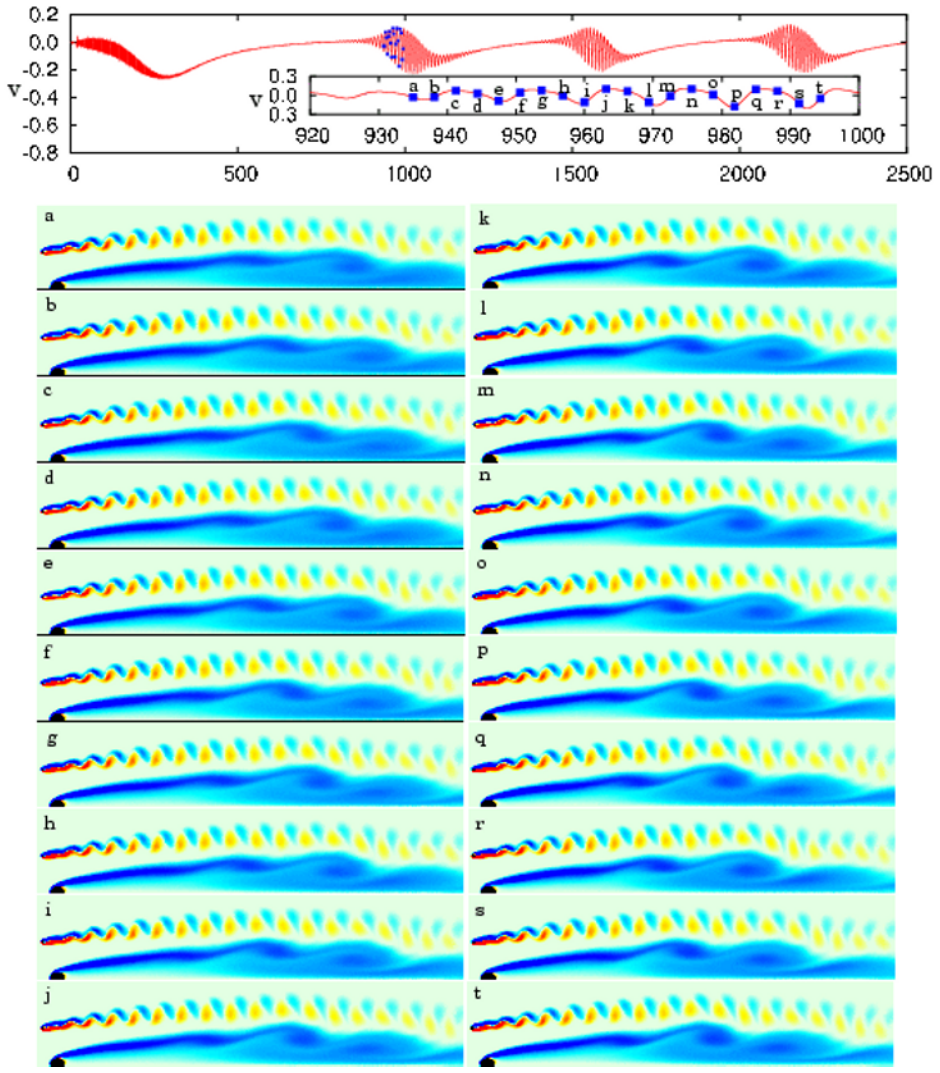

Fig. 1. *Re* = 300 flow past half a cylinder in the presence of a smaller secondary cylinder of one-fifth the diameter: time history of the vertical component of velocity at (15D, 2D) and vorticity field at various time instants. Red color indicates counter-clockwise while the blue color shows clockwise vorticity.

The critical Reynolds number (Re_c) for the onset of the shear layer stability in the wake of the cylinder has been a topic of debate in the past. While some researchers have found $Re_c \sim 1200$, others have observed shear layer vortices at *Re* as low as 350. Here, we investigate the instability of the separated shear layer for the *Re* = 300 flow. To suppress the primary wake instability, flow past half a cylinder with symmetry boundary conditions at the wake center line is considered. It is found to be stable. However, when the separated shear layer is excited by the vortex shedding from a secondary cylinder, it looses stability. The secondary cylinder, located at (-1.0D, 2.5D) with respect to the center of the half cylinder, is one-fifth its diameter (D). Figure 1 shows the time history of the vertical component of velocity at (15D, 2D) and the vorticity field at various time instants. The shear layer instability can be clearly observed. It is periodic, but intermittent in nature. The computations have been carried out using a stabilized finite element forulation. The mesh consists of 97,474 nodes and 194,056 triangular elements.