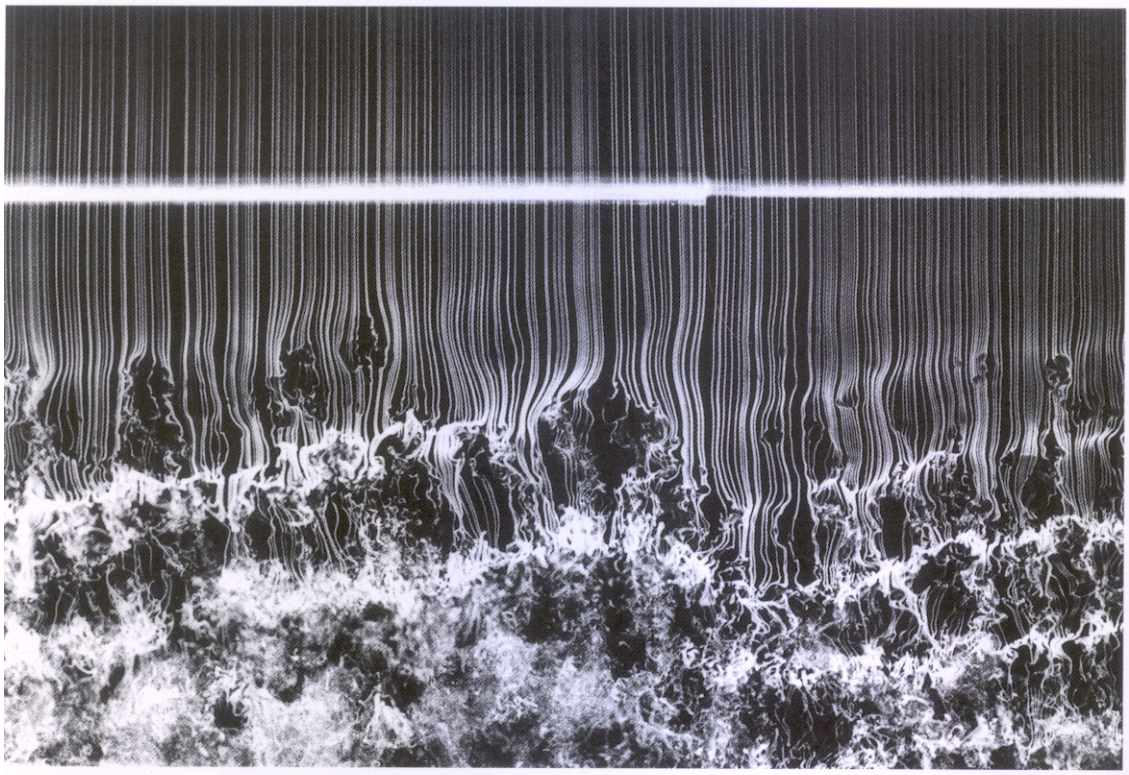
Flow around Cylinders Joined with a Step in the Diameter

Norberg, Christoffer

Published in:
Album of Flow Visualization

2000

Album of Flow Visualization No. 17 (2000)



22. Flow around Cylinders Joined with a Step in the Diameter

22. Flow around Cylinders Joined with a Step in the Diameter

C. Norberg (Lund Institute of Technology)

Keywords: Circular cylinder, Step, Diameter, Smoke-Wire

The picture shows streaklines in a spanwise view at a diameter ratio of $d/D = 0.6$ and for a Reynolds number of $Re = 4,100$, based on the larger diameter ($D = 10$mm). Smoke filaments are generated from a platinum wire of diameter 0.05mm positioned 6mm away from and 0.3m upstream of the cylinder axes. Lightning is provided from a stroboscope lamp with a flash duration time of about 10 microseconds. The aspect ratio on the larger diameter side is 56. The shedding flows at distances far from the step have a highly regular, although turbulent, vortex formation. The vortex streets on each diameter side do not connect directly, the vortex connections are brought about through a junction cell, the main extent being from about $6D$ into the larger diameter and about $1D$ into the smaller. The cell shedding frequency is constant and about 8 % lower than for the undisturbed flow on the larger diameter side. The flow on the smaller diameter side adjusts itself to seemingly unaffected conditions within a few diameters D from the junction. On the smaller diameter side there is a bending of vortex filaments from the cylinder axis but the shedding frequency on this side is constant and equal to the undisturbed value. The vortex filaments on the larger diameter side, outside the junction cell, are bent towards the axis and the shedding frequency is lower than the undisturbed value. The shedding frequency on this side varies continuously and does not fully recover until about $30D$ from the step. The picture also shows evidence of secondary mode B vorticity structures, with a spanwise wavelength of about one local diameter.

The Visualization Society of Japan, ISSN 0919-4630