STREAMLINE TOPOLOGY IN VORTEX STREETS

MARK A. STREMLER

Department of Mechanical Engineering
Vanderbilt University
Nashville, Tennessee 37235, USA
mark.stremler@vanderbilt.edu

MORTEN BRØNS

Department of Mathematics
Technical University of Denmark
DK-2800 Kgs. Lyngby, Denmark
m.brons@mat.dtu.dk

A standard approach to modeling the laminar wake of a bluff body is to consider point vortices in two-dimensional potential flow with periodic boundary conditions. When the vortex street is modeled as two oppositely signed vortices in a singly periodic strip, any choice of vortex positions gives a uniformly translating relative equilibrium. In the case of the staggered Kármán street, the wake translates along its length, and adjacent co-moving points (i.e., stagnation points in a frame moving with the vortices) are joined by streamlines. For small deviations from this ideal case, however, the wake translates obliquely, and the streamline structure can become quite intricate. Fluid entrained in the wake can be wrapped around many of the vortices before passing through to the other side. The bifurcations that occur in the streamline topology of obliquely translating vortex streets and the influence of this structure on mixing in wakes will be discussed.