

Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Structural sensitivity of the wake behind a rotating cylinder

LUCA BRANDT, KTH, Mechanics, Linne Flow Centre, Stockholm, Sweden, JAN
OSCAR PRALITS, FLAVIO GIANNETTI, DIMEC, University of Salerno, Italy —

The stability of the flow around a rotating circular cylinder is considered for rotation rates between zero and six and Reynolds numbers below 200. Newton iterations, eigenvalue analysis and direct numerical simulations are used to compute the base flows, the instability modes and to investigate the nonlinear shedding frequencies. Besides the classic vortex street, quenched at rotation rates of about 2 (defined as the ratio between the velocity of the cylinder surface and the free-stream velocity), a second shedding, of lower Strouhal number, is observed in agreement with previous numerical studies for rotation rates between 4.4 and 4.8, the values indicated being slightly dependent on the Reynolds number. The computation of the direct and adjoint linear instability modes allow to identify the region in the flow which most affect the instability. This is located on the back of the cylinder and follows its surface in the sense of rotation. Multiple solutions, with one stable branch, are found at the highest rotation rates, thus explaining the second flow stabilisation.

Dan Henningson
KTH, Mechanics, Stockholm, Sweden

Date submitted: 31 Jul 2007

Electronic form version 1.4