Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Investigations of vortex-cylinder mechanism of interaction using URANS and LES MARCEL ILIE, Carleton University — Numerical simulations of a single vortex superimposed on a uniform flow past a circular cylinder were performed using both unsteady Reynolds-averaged Navier-Stokes equations (URANS) and large eddy simulation (LES) techniques for relatively high Reynolds number flows, Re = 1.4x10^6. Vortex-structure interaction flow phenomena are very common in many engineering applications, such as aircraft at high angle of attack, flow past landing gear, blade-vortex interaction for rotorcraft, etc. The vortex-structure interaction phenomenon is of critical importance due to the inheriting danger associated with the vortex induced vibrations. In the present analysis, parametric investigations were performed for different test cases, based on both the vortex-cylinder horizontal miss distance and the sense of vortex rotation. The URANS approach fails to accurately predict the unsteady flow field due to excessive dissipation. The LES technique provides a promising tool for obtaining the unsteady wall-pressure fields, aerodynamic coefficients and the acoustic source functions. From the present analysis using LES, it was observed that the presence of the vortex in the flow field causes an increase of the Strouhal number value. Also, the present analysis showed that the vortex-cylinder horizontal miss-distance influences the mechanism of interaction and implicitly the aerodynamic coefficients.

Marcel Ilie
Carleton University

Date submitted: 07 Aug 2007 Electronic form version 1.4