DRAG PREDICTION IN THE VERY NEAR-WAKE OF A CIRCULAR CYLINDER BASED ON DPIV DATA

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KEYWORDS:

Main subjects: wake survey, flow visualization
Fluid: low speed flows, near-wake of circular cylinder
Visualization method(s): DPIV
Other keywords: image processing, drag prediction

ABSTRACT: Both the 2D flow around circular cylinders and accurate prediction of drag have received extensive interest in the past [1, 2]. Nevertheless, there are still several issues to be addressed and clarified [3]. This study focuses on drag prediction in the very near-wake of a circular cylinder and discusses the closest location where a wake survey would yield an accurate result. Although the investigation considers both the mean and fluctuating velocities, the focus is on the mean momentum deficit which should be handled properly beyond a critical distance.

The velocity fields in the near wake of a circular cylinder are obtained via Digital Particle Image Velocimetry (DPIV). Three different diameter cylinders are used and with overlapping regions, the Reynolds number ranges from 100 to 13 000. Depending on the diameter of the cylinder, the field of view may be as small as a couple of formation lengths downstream of the cylinder.

Figure 1 shows streamlines of the mean flow field along with the u_{RMS} and v_{RMS} distributions for the circular cylinder at Re = 1000 obtained using two different diameter models. There are two integrals yielding the drag coefficient, namely the mean momentum deficit (I_1) and the contribution from the normal Reynolds stresses (I_2). Figure 2 visualizes the variation of I_1 and I_2 with respect to the distance from the cylinder of 30mm-diameter.

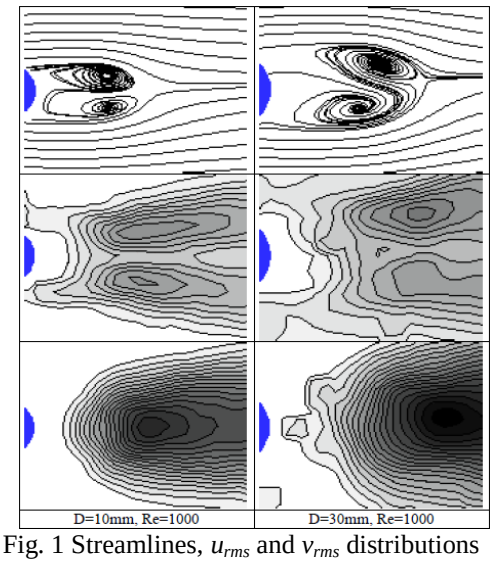

Fig. 1 Streamlines, u_{rms} and v_{rms} distributions

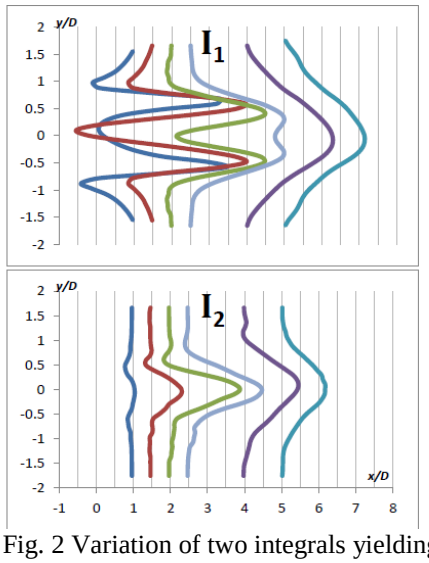

Fig. 2 Variation of two integrals yielding the drag

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