ELSEVIER

Journal of Wind Engineering
and Industrial Aerodynamics 96 (2008) 640–655

JOURNAL OF wind engineering AND industrial aerodynamics

www.elsevier.com/locate/jweia

Large eddy simulation of flow past rectangular-section cylinders: Side ratio effects

A. Sohankar

Department of Mechanical Engineering, Faculty of Engineering, Yazd University, Yazd, Iran

Received 10 May 2007; received in revised form 20 January 2008; accepted 11 February 2008
Available online 18 April 2008

Abstract

In this paper, the flow characteristics around rectangular-section cylinders with different side ratios ($R =$ width/height) of 0.4–4 are studied for $Re = 10^5$. The effect of Reynolds number is also examined for some cases. Unsteady and three-dimensional computations are performed using large eddy simulation (LES) with two subgrid-scale models, the Smagorinsky (S-Model) and a one-equation model (OE-Model). An incompressible three-dimensional (3D) finite volume code with a collocated grid arrangement is used for solving the filtered Navier–Stokes equations. These equations are solved with an implicit fractional two-step method. A series of instantaneous and time- and spanwise-averaged resolved velocity, pressure, turbulent stresses, and streamlines are provided. Time-averaged global quantities such as the Strouhal number, the mean and the RMS values of drag force, the base suction pressure, the lift force, and the pressure coefficient are also calculated and compared with available experimental results.

Keywords: Rectangular cylinders; Side ratio; Large eddy simulation; Reynolds number

1. Introduction

Bluff bodies are common configurations found in many structures and industrial applications such as tall building, bridges, towers, chimneys, cars, heat exchangers, vortex flowmeters, wires, and so on. These bodies usually create a large region of separated flow and a massive unsteady wake region downstream and they have susceptibility to

E-mail address: asohankar@yazduni.ac.ir

0167-6105/$ - see front matter
doi:10.1016/j.jweia.2008.02.009