THE EIGHTH ASIAN CONGRESS OF FLUID MECHANICS (ACFM-8)

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May 15 1999

Dear Prof./Dr. M. A. Badri,

We are pleased to inform you that your paper entitled

"Investigation of Creeping Flow Past Cylinders by Numerical Solution (No. 110-1)

has been accepted for ACFM-8 and will be published in the Proceedings of the Congress. Enclosed please find the format instruction for preparing your paper. Please note that the deadline for receipt of camera-ready manuscripts, together with a disk containing the electronic file, will be September 1, 1999. The camera-ready manuscripts should be sent to

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15 Zhong Guan Cun Road
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If you would like to send the electronic data of your papers via email, please send to the following address:

lxjz@imech.ac.cn

We will send you the formal registration form and the second announcement of the Congress soon.

We are looking forward to your participation in ACFM-8.

With best regards

Yours sincerely

Cui Erjie

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INVESTIGATION OF CREEPING FLOW PAST CYLIND BY NUMERICAL SOLUTION

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ABSTRACT: To determine fluid flow specifications,either internal or external it is necessary to solve for the non-linear Navier stockes and continuity equations .

Here ,a field method is used to solve the fluid features. In that , the domain has been discretized to some two-dimentional elements for two dimentional problems . Then ,the Mass and Momentom conservation laws have been applied to determine drag coefficient .

A finite volume method based on finite difference approach was used for simulation of the governing equations .The results show good agreement with numerical and experimental data and it became clear that , by using cartesian coordinates , the approximations made for confirmity to the curvature of body , introduces the least amount of acceptable errors .

I. INTRODUCTION

In this work,steady and incopnıresible flow at very low Reynolds numbers ($Re = uD / \upsilon < 1$) around cylinders has been studied . Where u is free stream velocity and D is a characteristic dimension .

Flow past a cylinder has an old background and is a basic field of study in CFD.This is due to phenomenon like separation of flow , vortex shedding and wide range of its applications in industries , for example cylindrical components are widely used in offshore structures.

If reynolds number is less than one , inertial forces in comparison with viscous are negligible and the equations can be estimated (OSEEN solution , Batchelor [1]). In this case streamlines are symmetrical and regular , there is no vortex shedding and time variations .[3]

II. GOVERNING EQUATIONS

Using cartesian coordinate system , two-dimentional governing equations in non-dimensional form may be expressed as :

- Continuity Equations , $$\partial u^* / \partial x^* + \partial v^* / \partial y^* = 0 \qquad (1)$$

- Momentum Equations , $$\frac{\partial P^*}{\partial x^*} = \frac{1}{\mathrm{Re}}\left(\frac{\partial^2}{\partial x^{*2}} u^* + \frac{\partial^2}{\partial y^{*2}} u^*\right) \qquad (2\text{-}1)$$

$$\frac{\partial P^*}{\partial y^*} = \frac{1}{\mathrm{Re}}\left(\frac{\partial^2}{\partial x^{*2}} v^* + \frac{\partial^2}{\partial y^{*2}} v^*\right) \qquad (2\text{-}2)$$

$$u^* = u/U, v^* = v/U, x^* = x/D, y^* = y/D, p^* = \frac{p + \rho g y}{\rho U^2}, \mathrm{Re} = \frac{UD}{\upsilon}$$