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NUMERICAL SOLUTION OF FLOW FIELD PAST A CYLINDER IN LOW REYNOLDS

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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 the Momentum conservation laws have been applied to determine drag coefficient and the length of vortex zone .
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 .

1. Introduction

In this work , steady and incopmresible flow at low Reynolds numbers ($Re=uL/\upsilon<40$) around cylinders has been studied . Where u is free stream velocity and L 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 stractures .

If reynolds number is less than one , inertial forces in comparison with viscous forces are negligible and the equations can be estimated (OSEEN solution , Batchelor [1]) .In this casc streamlines are symmetrical and regular where there is no vortex shedding and time variations . If reynolds number is greater than one , the OSEEN solution is not accurate and there is no analitical solution for governing equations . Therefore numerical or experimental methods are utilized . Numerical works of Thom [2] for Re=10,20 , Aplet [3] for Re=40,44 , Keller & Takami [4] for Re=2,4,10,15 and experimental results of Tritton [5], is non analitical solution for flow past cylinders .

Researches have shown that for Re>1 a twin vortex is apeared behined the cylinder Batchelor [1]has introduced this Re number about 6 and White[6] about 7 and 6 from this work

2. Governing Equations

Using cartesian coordinate system,two-dimentional governing equations may be expressed as:

- Continuity equation ,

$$\partial u/\partial x + \partial v/\partial y = 0 \qquad (1)$$