International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 5 Issue: 6 1137 – 1139

Introduction to Fluids in Motion

V. Manjula[1]
Research Scholar ,
K.LUniversity
Guntur, India
manjulavinnakota11@gmail.com

Dr.K.V.Chandrasekhar
Associate professor
K.L.University
Guntur,India
kasulanati@rediffmail.com

Abstract— This paper serves as an introduction to the concept of fluid motion. It is an attempt made to introduce the fundamentals of fluid flow. Fluid motion manifests themselves in many different ways. Some common assumptions used to simplify a flow situation are related to fluid properties. Under certain conditions viscosity can affect the flow significantly. The compressibility of a gas in motion should be taken into account if the velocities are very high. Fluid flow analysis is used to predict the behavior of systems which involves fluid flow. Computational Fluid Dynamics is the method to perform Fluid flow analysis and utilizes numerical methods and algorithms to address the problem that includes fluid flow. This paper consists of a brief view of different types of flow,basic equations etc. At the outset the beginning is the description of the basic ideas of fluid flows, Flow patterns, methods to describe fluid motion etc. The paper ends with general analysis of fluid motion through ANSYS CFD software, because the visualization of flow patterns permit the development and better understanding in formulating a mathematical problem.

Keywords-*Modeling and simulation,CFD Analysis*

*****

I. INTRODUCTION

All Fluid dynamics is the science treating the study of fluids in motion.

Generally fluids are of two types

(1)Liquids which are compressible.

(2)Gases which are compressible

Fluid dynamics plays an important role in, manufacturing, environment, industry, medicine and biology, etc. i.e prediction of the aerodynamic behavior of moving vehicles, movement of physiological fluids in human body, the weather prediction, cooling of electronic components ,etc. On the basis of density and viscosity fluids are classified as inviscid and viscous fluids. Flow is dependent on the intrinsic properties such as density, compressibility,and viscosity. A liquid flowing through a pipe or air moving across an aeroplane wing, and plasma motion in a stars magnetic fieldare such systems.The science of moving incompressible fluids is known as hydrodynamics. For a continuous or ideal fluid particle as the fluid contained within an infinitesimal volume whose size is very small and it may be treated as a geometrical point velocity acceleration.

II. FLOW PATTERNS

Stream lines : Stream lines are geometrical representation of flow velocities.

Path Line: Path line refers to a path followed by a fluid particle over a period of time. It is the actual path transverse by a given particle.

Streak line is the locus of particles which have earlier passed through a prescribed point in a space.

Flow patterns in a fluid depend on the characteristics of the fluid, the speed of flow, and the shape of the solid surface. Viscosity is the resistance to flow. So that Water is less viscous than honey and flows more easily than does honey.

On the basis of density and viscosity fluids haven classified as inviscid and viscous fluids

Inviscid or Ideal Fluid;

An Ideal fluid is one, which has no property other than density. No resistance is encountered when such a fluid flows. The pressure at every point of an ideal fluid is equal in all directions, whether the fluid is at rest or in motion.

Viscous Fluid: Viscous fluids or real fluids are those, which have viscosity, surface tension and compressibility in addition to the density. Viscous or real fluids are those when they are in motion,.

Viscous fluids are classified into two categories.

a) Newtonian fluids b) Non- Newtonian fluids

Newtonian Fluid

According to Newton's law of viscosity, for laminar flows, the shear stress is directly proportional to the strain rate or the velocity gradient.

$\tau = \mu \quad dy/du$

where μ is the constant of proportionality and is the dynamic viscosity of the fluid. The fluids obeying the Newton's law of viscosity are called as Newtonian fluids. Water, air, mercury are some of the examples of Newtonian fluids.

Non - Newtonian Fluids

Non –Newtonian fluids are those fluids which do not obey Newton's law of viscosity and the relation between shear stress and rate of shear strain is non-linear. These include paints, coaltar, polymers, lubricants, plastics, printer ink and molecular materials etc.

Types of Fluid Flow

Steady and Unsteady Flows

A steady flow is one in which the velocity and pressure may vary from point to point but do not change with time. If, at a given point, conditions do change with time, the flow is described as unsteady .

Uniform& Non Uniform Flows

Flow is described as uniform if the velocity at a given instant is the same in magnitude and direction at every point in the fluid. If, at the given instant, the velocity changes from point to point, the flow is described as non-uniform

A flow is said to be one-, two-, or three-dimensional if the flow velocity varies in one, two, or three dimensions, respectively

External flow: The flow of an unbounded fluid over a surface such as a plate, a wire, or a pipe is an external flow

Internal flow: The flow in a pipe or duct if the fluid is completely bounded by solid surfaces is internal flow

Incompressible flow: If the density of flowing fluid remains nearly constant throughout e.g., liquid flow.

Compressible flow: If the density of fluid changes during flow e.g., high-speed gas flow

Methods of describing Fluid motion

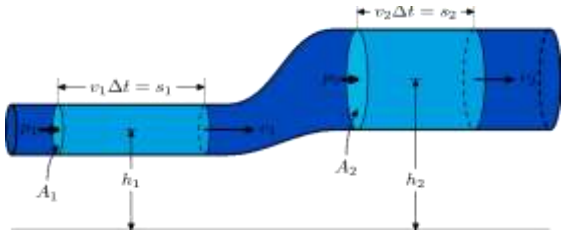
Laminar flow: The fluid motion characterized by smooth layers of fluid is called Laminar flow. The flow of high-viscosity fluids such as oils at low velocities is laminar.

Turbulent flow: The fluid motion that occurs at high velocities and is characterized by velocity fluctuations is called turbulent flow. The flow of low-viscosity fluids such as air at high velocities is turbulent.

.

Bernoulli principle

An increase in the speed of the fluid occurs simultaneously with a decrease in pressure or a decrease in the fluid´s potential **energy**



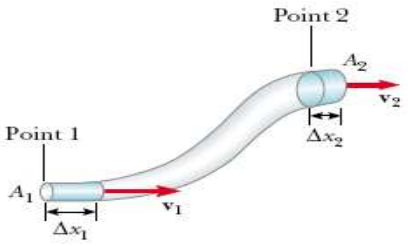
”

$$P + \tfrac{1}{2}\rho v^2 + \rho g y = \text{constant}$$

Equation of continuity of fluids

$$A_1 v_1 = A_2 v_2$$

The product of the area and the fluid speed at all points along pipe is constant for an incompressible fluid



III. MODELLING AND SIMULATION

A model can be defined as a formal representation of relationships between qualities or quantities. Explanation of natural phenomena and prediction of future are the major uses of mathematical modelling. Simulation is equated with modelling, it is the development of mathematical models of physical systems on computers. Imitation of operations of real world is simulatin. It can also be system over time whether done on a computer or by hand. But in our world many systems are so complex that implementing a model under these conditions is difficult. To analyze the behavior of system numerical, computer based simulations can be used. to understand better the physical events that occur in the flow of fluids within the designated objects. Computational fluid dynamics can be employed.

CFD based software package is used to solve fluid dynamics problems without required time period. ANSYS is a computational fluid dynamics software for modeling fluid flow and other related physical phenomena.. The primary ANSYS products in the fluids area are ANSYS Fluent and ANSYS CFX. The graphic results of an ANSYS CFD software simulation will show you how fluid flow, particle flow, heat transfer, chemical reactions, combustion, and other parameters evolve with time.

IMPORTANCE

To analyze the behavior of a fluid, pattern of flow simulation procedure can be used. As a research tool this procedure has numerous advantages. By changing the geometry, Material of the system, type of the liquid the changes can be investigated. It is useful to visualize animations, graphics, particle track etc. More over by using function calculation various parameters like volume, heat flux etc can be determined using chart view. The relations between the variables can be examined

.

IV. CFD ANALYSIS

CFD analysis consists of three main elements

1.Pre-processor
2.Solver
3.Post –processor

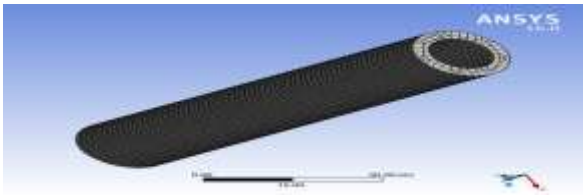
Problems setup-pre processor ;Laminar flow through pipe

Step-1Creation of geometry:

- Creation of geometry to the required flow is the first step

.

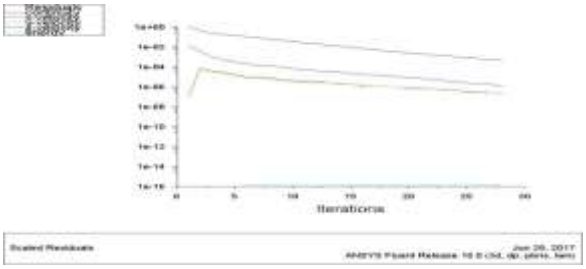
Step-2
Mesh generation
CFD needs the subdivision of domain into smaller number,non overlapping of sub domains in order to solve the flow physics with in the domain.In general,if we provide large number of cells,that gives accurate solutionuations



Step-3:
Selection of physics and fluid properties:
It is necessary that setting up the flow physics is accompanied by ascertaining which fluid is used within the flow domain.
Step-4:Specification of boundary conditions:
The fourth step is about specification of boundary conditions that are available for simulation i,e where there exist inflow and outflow boundaries within the domain are required to identify the fluid behavior

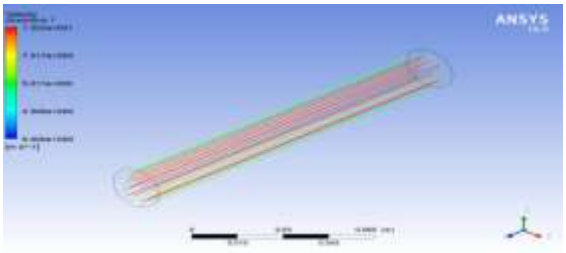
RESULT REPORT AND VISUALIZATION

CFD can provide detailed information of flow process with vivid graphic ranges



In CFD X-Y plots are mainly two dimensional graphs that represent the variation of one dependent variable against other independent variable .Such X-Y plots are the most quantitative way to present numerical data.

Animation: Animation is an effective visualization tool which represents a technical record of quantative results



File Report

Case	FFF
File Path	C:\Users\bit\Desktop\Flow through pipe lam and turb_files\dp0\FFF\Fluent\FFF.1-1-00028.dat.gz
File Date	28 June 2017
File Time	07:22:38 PM
File Type	FLUENT
File Version	16.0.0

CONCLUSION

Fluid dynamics plays an important role in, manufacturing, environment, industry, medicine and biology, etc. To analyse the behaviour of a fluid, pattern of flow simulation procedure can be used. The visualization of flow patterns permit the development and better understanding in formulating a mathematical problem.

.

REFERENCES:

[1] **F**.Chorlton, Textbook of Fluid Dynamics CBS Publishers
[2] C.Potter ,Mechanics of Fluids , ,fourth Edition,Centage learning
[3] Jiaun Tu computational Fluid Dynamics A Practical Approach,Elsevier India ltd
[4] Roger K. Smith Version Introductiory Lecture notes on FLUID YNAMICS
[5] Henryk Kudela Fundamental Concepts Relating to Fluids
[6] Prof. Dr. Atıl BULU FLUID MECHANICS
[7] Henryk Kudela Equation of Fluid Motion
[8] Dr. R.K.Jain]. Fluid Mechanics
[9] Dr.R.K.Bansal, Fluid Mechanics and Hydraulic Machine