

A fluid is a substance that deforms continuously on application of slight shear stress. The study of fluid mechanics deals with motion of fluids and conditions that support or after motion.

Fluid mechanics can be divided into fluid kinematics and fluid dynamics. Fluid kinematics deals with forces involved in motion of fluid, whereas fluid dynamics deals with the state of fluid in motion caused by imbalances of forces acting on it.

Kinematics of fluid motion uses vector quantities such as; velocity, acceleration and rate of discharge which is defined in terms of scalar quantities; length and time in some specified coding system. These depend on some boundaries of a particular system under in investigation.

Fluid dynamics involves the applications of Newton's second law of motion that states:- rate of change of momentum is directly proportional to the applied force; Transfer of fluids through pipes involves changes in potentials/pressure energy between two ends of the pipes under study. This potential difference can either be caused by: -

(a) Gravitational differences (g)

(b) Differences in height (h) (Potential energy)

(c) Density differences, (p), for example that caused by concentration differences, Beek (1985). These three factors are related by equation (i) on the next page.

$$P = \rho gh \dots\dots\dots(i)$$

The flow of fluids in channels can either be turbulent or laminar. Flow is where the streamlines do not intersect such that there is no mixing up of fluids. Laminar flow occurs when fluid has;

1. Low Reynold's number ( $Re < 2000$ )
2. Low viscosity (internal friction of fluid particals)
3. Friction between the channel and the fluid negligible.

Turbulent flow occurs where there is continuous mixing up of the fluid in motion. This type of flow occurs when the fluid has;

1. High Reinhold's number
2. High viscosity.
3. Boundary of channel and fluid have got high friction.

Fluids transfer can either occur in open or closed channel depending on the geometry of the channel. Open channels are like surface run-off, rivers and streams, dug-out drains, of which all have got a free surface while confined (closed) flow occurs in porous media, closed cracks and in pipes.

Fluid flow in both types of channels have got its uses, but highlighted here are only importance of closed channel flow. That is the used both in domestic and industrial sectors. In domestic side flow in closed channels are important in areas, for example in passage of fluids for example water from one point to other. It is important to have piped water at our vicinity especially at this age of development.

On the industrial side, flow in closed channels at factories is important and to mention a few examples, are in areas like; -

1. Sewage collection and disposal.
2. Passage of oil, for example the oil pipeline from Mombasa to Eldoret
3. Passage of raw materials in chemical processes, for example breweries
4. Passage of gases in geothermal plants like in Olkaria

In this work, only confined type of flow will be considered in a uniform circular cross sectional bend of a pipe. The fluid here is a liquid, for example water. And since the fluid delivered need not necessarily follow a straight path definitely there will be bends in pipes. Shapes such as this might be met in area like: Sprinkler nozzles. Nozzles of sprayers and spouts of various utensils like kettles.

Detailed knowledge on fluid flow and the prevailing suitable conditions for laminar flow must be well defined as given earlier. In this work, however. We seek to give a clear picture on: -

1. Pressure distribution.
2. Velocity distribution and profile where necessary.
3. Forces acting on the pipe at certain parts.

We therefore consider in detail how flow factors are affected by the shape of the region of the pipe considered. The proper interaction balance of these factors play a role in flow mechanism. Earlier, various analyses on straight pipe of some geometry Douglas (1995). The writer has analysed flows by application of methods of differential calculus and coupled with a well-defined boundary conditions have given practically near accurate results. On basis of the results obtained by this method it has become evident that complete, continuity, momentum and energy (Bernoulli) equations have to be well understood. In most of flows in pipes, velocity distribution, pressure distribution and force analysis are investigated by use of calculus modified by trigonometric ratios with successful results. Differential models has been powerful in predicting a number of flow problems in diverse fields of flow in the past decade.