ORIGINAL RESEARCH PAPER

Engineering

LEAK DETECTION IN PIPES

KEY WORDS:

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ABSTRACT

As we approach the next century, more than a quarter of the world's population, or a third of the population in developing countries live in regions that will experience severe water scarcity.In the semi-arid regions of Asia and the Middle East, which include some of the major bread baskets of the world, the groundwater table is falling at an alarming rate.There is an urgent need to focus the attention of both professionals and policy makers on the problems of groundwater depletion and pollution is seen as a major threat to food security in the coming century.Water Scarcity is the burning topic of today's context.We are not awared about the wastage of water which can even accumulate to the major portion of ocean. Lack of fresh water accumulation on earth surface is driving us to carry out such methodology to detect the water leakage so that we can atleast design our effort to save the fresh water .Leakage can occur because of many factors such as excess pressure at a particular point , static or fatigue failure of the component . We can use different governing equations to measure the flow rate .

INTRODUCTION

The leakage from pipelines in various industrial applications is the cause of environmental problems and the loss of conveyed fluid, It is therefore essential to detect the location of unintended leakage resulting from cracks, holes and pores. This requires the knowledge of pipe geometrical configu ration and nature of fluid inside it.

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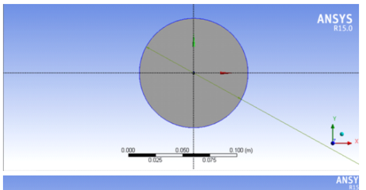
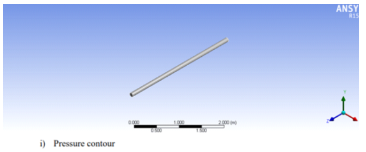
The regime of flow when velocity is lower than "critical" is called laminar flow (or viscous or streamline flow). At laminar regime of flow the velocity is highest on the pipe axis, and on the wall the velocity is equal to zero.

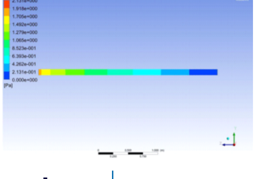
When the velocity is greater than "critical", the regime of flow is turbulent. In turbulent regime of flow there is irregular random motion of fluid particles in directions transverse to the direction on main flow. Velocity change in turbulent flow is more uniform than in laminar. In real piping system, losses of energy are existing and energy is being added to or taken from the fluid (using pumps and turbines) these must be included in the Bernoulli equation.

MODELLING

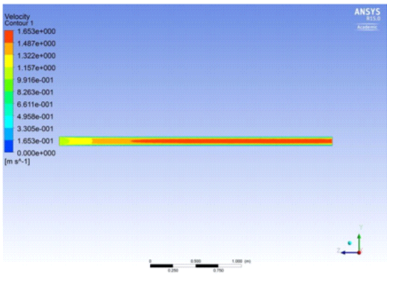




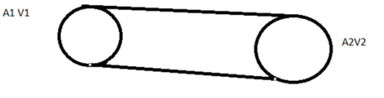
i) Pressure contour



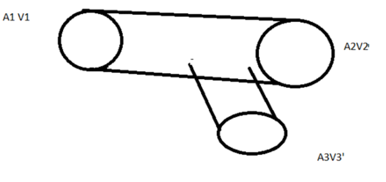
ii) Velocity contour



Calculations



A1V1=A2V2 {From continuity equation]
For uniform section
A1 = A2;
So we can say that
V1=V2



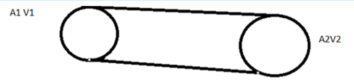
When there is hole in the pipe(suppose at some distance from the outlet) we will experience two channels of fluid flow
A1V1=A2V2'+A3V3'
A1V1-A3V3'=A2V2'

$$\frac{A1V1-A3V3'}{A2} = V2'$$

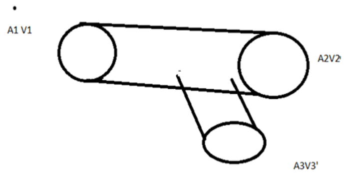
$$\left[\frac{A1}{A2}\right]V1 - \left[\frac{A3}{A2}\right]V3' = V2'$$

From this we can say that , There must be some reduction in the velocity at the outlet velocity.velocity detected at the outlet implies that there must be some leakage in the pipe.

BERNOULLI THEOREM APPLICATION FOR THIS CONCEPT
Assumptions
We have assumed outlet pressure as 0 for this simulation



P1 + ½ (ro)V1^2 + (ro)gh = P2 + ½ (ro)V2^2 + (ro)gh
P1 + ½ (ro)V1^2 = ½ (ro)V2^2
P1 = 1/2(ro)(V2^2 -V1^2)



Similarly we can write
P1'= ½ (ro)(V2^2 -V1^2)

From this we can conclude that , inlet pressure in second case is less than first case.

RESULTS AND CONCLUSION

Reduction in inlet pressure and Reduction in outlet velocity of a pipe can arrow the symbol of leakage in a pipe.We can measure the pressre of inlet by using inclined manometer and measurethe outlet velocity by using flow meters.Once difference in the velocity is detected we can carry out relevant procedures to hinder the leakage through pipes. ance, pressure monitoring, transient flow detection methods. The transient leakage detection has become one of the major applications of transient simulation techniques aiming to detect and locate pipeline leakage efficiently. In the present work a method of leakage from pipelines having cracks is introduced. It is based on the continuous introduction of sinusoidal pressure waves of small amplitudes at the entrance of the pipeline.

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