



A Review on Bends Pipes with Different Bend Angle Using FEA Method

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Abstract- In present paper, pipes with different bend angles are designed and simulated using computational fluid dynamic software for water with different temperatures. Pipe will be considered as real wall and its temperature distribution is measured to corresponding temperature boundary condition at inlet. Ultimately, influence of bend angle over heat transfer enhancement in pipes will explored computationally and experimentally.

Keywords:- Pipe bend, angle, temperature, CFD.

I. Introduction

1.1 Overview

Pipe bends are an integral part of engineering industry used for fluid flow such as liquid, gasses. The study of turbulent flow characteristics through pipe bends is significant for different engineering applications. Investigations of the turbulent flow in the bends are very important in understanding and improving their performance and minimizing the losses. As the liquid stream from gulf to the power source of the twist, the twist shape creates an outward power towards the external mass of the line from the flashing focal point of the arch. The optional stream is created by the joined presence of radiating and limit layer at the divider, creating two indistinguishable vortexes. This optional stream is superimposed to the standard along the line pivot, bringing about a helical shape smooth out moving through the curve [1]. The liquid at focus of the line moves towards the outside and returns along the divider towards the inward side. A twofold insect stream field is made by this. In the event that the twist curve is sufficient the antagonistic pressing factor inclination close to the external divider in the twist and close to the inward divider soon after the twist may prompt stream division now. Various specialists have examined fierce streams in a line twists through hypothetical, tests and mathematical techniques [2], [3], [4]. As of late in the atomic area because of the exhaustion by the shaky movement of the vortices, this has likewise drawn in light of a legitimate concern for the specialists [5], [6]. Twirling fierce move through pipe twists has been contemplated [7], mathematically [8], [9], [10] hypothetically [11]. However various analysts have effectively made a critical commitment regarding the matter, much is yet to be done to introduce a reasonable image of the major qualities. In this paper the stream attributes and consistencies of dispersion in the most widely recognized 90° line twist is concentrated by mathematical strategies dependent on computational liquid elements.



1.2 WEAR

Wear is described because the elimination of cloth among the sliding surfaces because of interlocking or roughness at the surfaces. Wear has a tendency to lack of the sturdiness and reliability of the subjected parts. So the right research and care need to be taken to manipulate it within side the rising technology.

1.3 TYPES OF WEAR

The diverse styles of put on are exist nature because of relative movement among the sliding floor, topics, our bodies and within side the aggregate of bodily topics solid, liquid and gas.

Types of damage are given below.

a) Abrasive Wear

In abrasive put on a difficult cloth is moved over the cloth, an interlocking is shaped among those inflicting a plowing movement shaped. Due to plowing movement the cloth from gentle cloth floor is plastically deformed or eliminated away and a groove is shaped at the eroded cloth floor as proven in determine 1.1. Example of abrasive put on is: shovels on the planet shifting machinery.

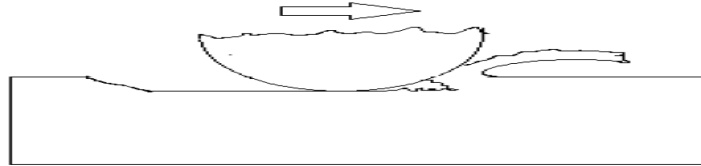


Figure 1.1: Abrasive Wear.

B) Adhesive Wear

In this kind of put on the connector connectors have robust adhesion / binding enough to resist the motion related among these. Splitting or splitting starts on the mating web website online below the movement of stiffening and slicing because of this bonding force.

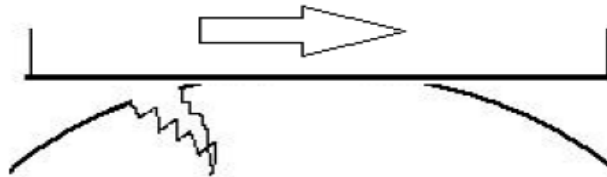


Figure 1.2: Adhesive Wear.

c) Corrosive Wear

In the manufacturing of liquefied drinks and gases the floor is made from the middle of the slope because of chemical reactions and the formation of electrical energy. The dependency of dressing in bulk is constructed up extra if the goods are too connected to the wall / floor and behave like many things. Temporary merchandise won't act as strong solids however the merchandise cause put on because of a response among strong and corrosive drinks.

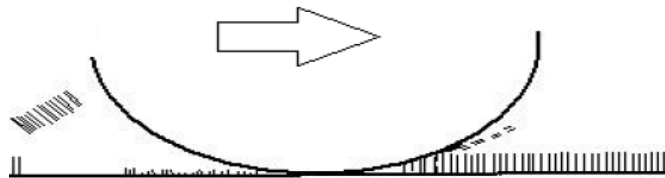


Figure 1.3: Corrosive Wear.



d) Fatigue wear

Fatigue put on takes place whilst the vicinity is just too dense or actions in a different way below neighborhood stress and bureaucracy sturdy debris that cause put on among regions e.g. nice contacts (wearing a ball). Low fatigue and excessive fatigue are forms of fatigue put on, relying at the variety of conversation cycles.

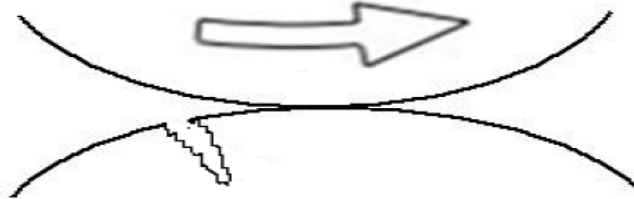


Figure 1.4: Fatigue Wear.

1.4 EXAMINATION FIELDS

Devices are used to degree the erosion price of weight reduction trying out samples. The organized check pattern rotates at the aspect of the pot and is immersed in a slurry pot. Due to the excessive pace of the check pattern in opposition to the consequences of the slurry above the perspective and the fabric from the enclosure is eliminated because of the adjoining debris. Finally weight reduction is calculated to explain the diploma of abrasion. Many forms of check rigs are utilized by researchers. Each erosion check web page has exclusive functions and discipline situations however the erosion approach is the same. The forms of check rigs are mentioned here:

a) Combined cylinder check cone

This form of check is used while the distinction among the quantity of liquid and the liquid is small because the debris might also additionally settle at some point of the dressing check.

b) Falling jet trying out equipment

Specimens circulated in a vacuum chamber and a jet of stable-liquid combinations fall right into a check template beneath the movement of gravity.

c) Corrosion erosion tester

This tester is used to check the wear and tear resistance of abrasion in numerous goal items beneath low-power situations (low pace and coffee effect perspective) of stable debris.

d) Jet on muddy materials

Slide erosion tester is used to test the wear and tear and tear of a exclusive form of composite fabric. The check includes a seen tank with extra chambers however smaller in diameter and a smaller room in diameter to save the liquid. In the above tank, easy water continues to be pumped through the pump with inside the check segment. The 4 samples with inside the organized check segment are beneath ground water waft and a few water is going to the lowest tank. The liquid jet popping out of the pipes is ready with inside the middle of the check pattern and the slurry is absorbed and influencing the check pattern at excessive pace main to the lack of fabric at the goal surface.

e) Pot inspector



The tester is used to check the wear and tear and tear of the rotating check pattern after a time frame in a exclusive attention. It includes a jar containing dust wherein the pattern samples are turned around at a fixed rpm. After a time frame the erosion price is measured with inside the shape of weight reduction of the check pattern.

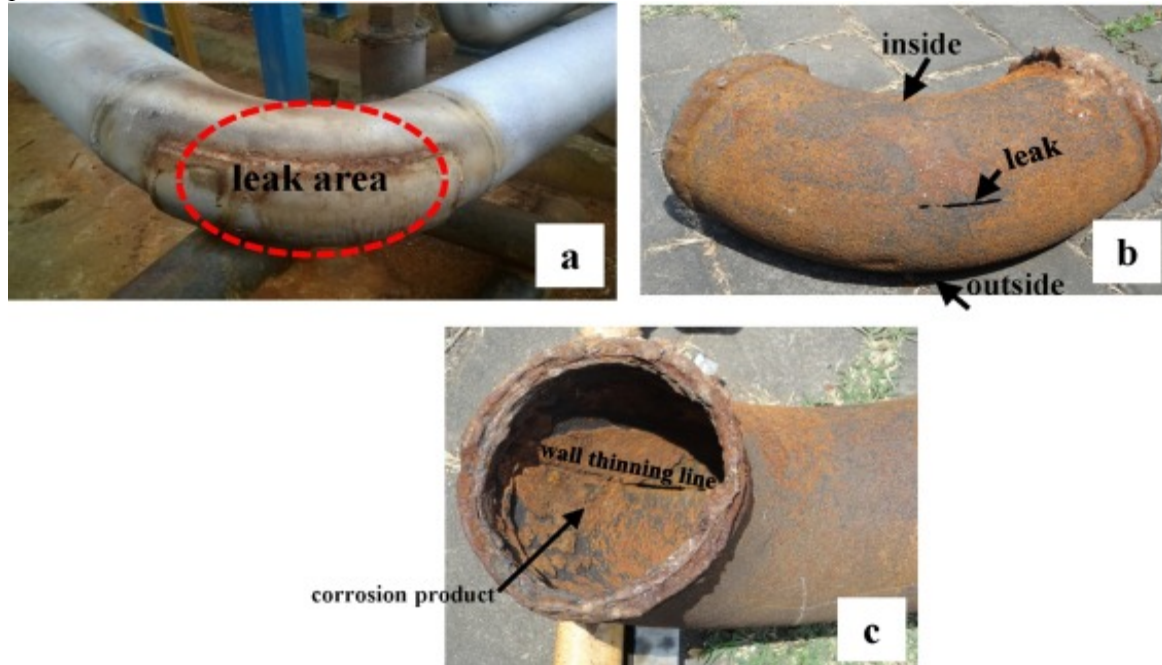


Figure 1.5: (a) Failure of pipelines.

II. Literature Survey

In the literature assessment the evaluation on erosion put on became noted through numerous authors. This bankruptcy became created whilst an in depth studying in their evaluation papers to give an explanation for their evaluation, findings, their outcome, and additionally the consequences of abrasion. Calculation and checking out methods used by researchers to evaluate erosion corrosion way to the shipping of stable debris through hydraulic and fueloline system.

Row (1970) test tested the warm temperature switch effect in massive wavy pipe way to secondary glide that outcomes in whole interchange of fluid inside the wall and additionally the imperative center line. Their paintings drastically specializes in unmarried phase glide in severa pipe bends like 100 80 U-bend, 45o/45o S-bend mounted to the pinnacle of an prolonged immediately pipe.[1]

Janyanti et al 1993 done CFD evaluation to have a take a observe the Gas-particle movement in 90o and 180o round cross-sectional pipe bends. They determined that the secondary glide evoked inside the fueloline phas-e way to curvature impacts the movement of the debris that reasons the maller debris to return back again out of the bend at the same time as now no longer deposition. [2]

Clarke and European 2008 numerically investigates the streamline glide of secondary working fluid like steel detail formate thru tool U-bends and placed that warmth switch will growth at downstream of the bend. [3]



Dhanasekaran 2012 carry out CFD evaluation of closed-loop steam cooling all through a 180-degree bend tube of superior turbine. Their objective is to confirmatory a CFD version towards experimental finally ends up in a 180-degree tube bend and making use of the version to expect the mist/steam cooling overall performance at turbine working conditions. The received outcomes display that the CFD version will expect the wall temperature at durations V-E Day of experimental steam-most effective glide and 16 pf of mist/steam glide condition. [4]

Georgios A. Florides 2013 advanced a numerical version for simulating Single and double U-tube floor warmth exchangers. The effect of multi-layer substrates on temperature distribution of floor tool. The version is moreover modified to allow the examine of a double U-tube GHE all through a unmarried borehole and additionally the evaluation of its efficiency with relevancy its constructing price. [5]

Pedro M. First State Oliveira. 2014. Gas-liquid flows in incurved tubes are determined all through a number of applications, like warmth exchangers and shipping pipes. the present day paintings offers with air-water glide in 180-degree bends (curvatures of 1/2 of dozen, 1, 8.7, and 12.2) that join 2 5-m lengthy 26-mm ID horizontal tubes. The bend lies inside the vertical role and additionally the twophase glide can be set as upward or downward. The immediately and incurved segments of test phase had been made of salt glass to regulate visible get right of entry to to the two-segment glide. [6]

Chen et al. 2015 thru an test analyzed the effect of period and bending attitude at the cooling overall performance of flat plate warmth pipes (FPHP) it is been determined that premiere liquid filling value relation will growth as period of pipe will growth. While, shorter pipe had a larger powerful thermal conduction, and implying extra expeditiously. The bending of pipe would not have an impact at the premiere liquid filling value relation of a FPHP. [7]

Hasanpour et al. 2016 studied warmth switch and friction don't forget a double pipe tool that has an internal furrowed tube filled with severa training of twisted tapes from popular to modified kinds that encompass perforated, V-reduce and U-reduce kinds. [8]

Bhusan et al. 2017 numerically look at the glide and heat switch traits in 100 80 bend pipe with having glide of water-fly ash suspension. In their paintings they considered RNG k- ϵ turbulence version. The stress drop and heat switch has been tested for factor glide mistreatment finite quantity approach. absolutely extraordinary particular and approximate strategies have conjointly been accustomed remedy the numerous problems in mechanics [9].

Duarte et al. [2017] The results showed that positive accord with experimental knowledge by considering wall violence contains a swish wall up imitation. by worth analysis and by making an attempt to attenuate the erosion of twisted pipe folds instead of interference. Minor erosion was found on the elbow thanks to the particle rotation of the 4-inch spiral designed for the bend of the pipe and also the versatile pipe bend. [10]

V. Singh et al [2018] within the gift study, 90o wing erosion corrosion was investigated mistreatment the procedure fluid dynamics code FLUENT. Solid particles were followed to assess erosion rate and also the and also the of the continual section / liquid flow field. Round-grained sand particles measurement 183 μm and 277 μm of mass 2631 kilogram / money supply are injected from the water with a speed starting from zero.5 to eight ms^{-1} in 2 completely different locations. By finding out the interaction between solid-liquid, the impact of speed, particle size and filtration was studied. Erosion



corrosion is increased by exposure to speed, particle size and concentration. the anticipated results for CFD are well expressed in accordance with the check results. the scale and site of the best erosion were additional incurved than the straight pipe. [11]

Vinay Sati et al [2019] very crucial position in severa fields of software like industries or home use. The reasonably priced transportation of fluid from one vicinity to a exclusive has been a critical problem persistently. There ar positive strength losses taking place withinside the glide of fluid on every occasion there is a amendment withinside the direction of its glide. for the duration of this paper accomplice diploma evaluation has been completed throughout the various preferred approaches used to get bent sections, on a 2-D geometric version of a pipe designed mistreatment machinedesk Auto CADD 2017. every alteration of direction of fluid flows outcomes withinside the lack of momentum of the fluid debris present at the outer layer. This lack of momentum with the aid of using the debris successively reason version a few of the fluid parameter like pace and pressure. These parameters been analyzed for the duration of this paper. All the calculations and simulations are completed at the 2-D axis-symmetric sketches of pipe fashions, i.e. mesh fashions below the phase of superior numerical approaches mistreatment ANSYS R16.0. The fluid being considered for the duration of this evaluation interest has been water [12].

Chukwugozie Jekwu Ejeh, et. al [2020] The rate of a pipeline could be a terribly advanced system as a result of it's greatly tormented by flow conditions. The transport of crude through pipelines at intervals uncollected fuel pools is related to the presence of solid particles. These particles ar usually transported as spread phases throughout the assembly of crude and thus harm the integrity of the pipes. this could cause the prevalence of road corrosion thanks to pipe erosion. With relevancy the higher than discussion, this paper aims to investigate the potential of crude throughout the flow of the pipeline and to spot the erosion curves of various elbow pipe. The Reynolds Averaging Navier - Stokes (RANS) and Particle Tracing Modeling (PTM) methodology was used. specialise in measurement fluid strength and particle trailing, severally. The results obtained when analysis showed that the speed fluid magnitude was considerably higher within the region in terms of curvature radius. High static degradation rates and turbulence were found in areas with low speed. Also, the wear and tear rate of the flood was terribly high on the elbow and also the hotspot varied with the bend of the pipe. Particle rate, size, and size varied and it had been found that the erosion rate enhanced with increasing particle size [13].

III. Methodology

The exploration became accomplished with none education and acted in diverse stages. The vital segment of the exploration covered the making plans of the road fashions, which became completed via way of means of using CATIA.

A. First Stage

We started out with the plans that need to had been checked for his or her trustworthiness. This became once more accomplished in a comparable programming via way of means of making use of the mathematical locale exams. Since all portions of the fashions have been best regions as obtained from the exams completed on them; the preliminary segment withinside the exam interplay became completed because the mathematical our bodies had extremely good locales displaying that there might be no misfortunes due to spillage anywhere whilst we play out the liquid circulation duplicate.

B. Second Stage

In the second one segment of exam, we imported the plan files into the CFD programming ANSYS R16.0. Then, at that point, we alloted the names to the segments of the road calculation as gulf, frame and outlet. This named dedication became accomplished as such that research at every location of the road in standard frame



may be completed. This became trailed via way of means of excellent lattice of every section became accomplished to provide unique charts whilst duplicate is completed. In end on this stage, we carried out the circulation bearing to the frame as inlet>frame>outlet individually.

C. Third Stage

The 1/3 segment of the exam became to pick the applicable situations for the coincided version created. As referenced, we carried out the Navier-Stokes circumstance and selected the K-Epsilon version to accumulate the effects for our calculation. These situations had been clarified similarly withinside the numerical showing section. D. Fourth Stage In the fourth stage, which being the primary segment of the exam became to do the duplicate of circulation.

IV. Conclusion

Requirement of heat transfer enhancement in heat transfer applications is increased to bring efficient process or products where ever necessary. Turbulence is induced in shell side of S & T exchanger by placing baffles to get more heat transfer rate. Some of the literatures speak about turbulence in U-bend of tubes in S & T exchanger and heat transfer enhancement. It is required to know relationship between pipes bend angle and heat transfer rate (indirectly turbulence) for future implementation in S & T exchanger tube.

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