

Pipeline Maintenance System for Long Distance Offshore Oil Pipelines

A. Prem Anandh

Department of Naval Architecture and Offshore Engineering, AMET University, Chennai, India

Abstract: This study presents an arrangement of new pipeline support system for early-fabricated long-remove seaward oil pipelines. An on-line insightful investigation pig is created utilizing ultrasonic apparatus to identify absconds in oil pipelines and the procured information is put away for disconnected examination. Through breaking down the information, deformities can be found, measured, classed, what's more, the arrangement to finding them is made. A autonomous pipeline robot is produced to do the finding absconds tusk which embraces the method for distinguishing bigness welds, joined with odometer wheels to find the deformities position, so, the issue of finding imperfections in early-manufactured seaward pipelines unequipped with attractive markers is illuminated. The study presents significant parts of the wise investigation pig and the independent pipeline robot and depicts the way toward keeping up seaward oil pipelines with the created system.

Key words: Intelligent pig, ultrasonic inspection, locating defects, autonomous pipeline robot, early, India

INTRODUCTION

It is by and large acknowledged that high weight pipelines give the most effective and most secure intends to transport vast amounts of oil and gaseous petrol (Can *et al.*, 2001). In China, bunches of oil pipelines were covered in the mainland rack of Bohai Sea straight from 1970-1980. The area's physiognomy is perplexing and seabed under sea wave's disintegration is shaky. So, the oil pipelines presented to an assortment of ecological impacts and stacking conditions have keep running more than 30 years (Gunarathne and Qureshi, 2005). The examination pig with ultrasonic instruments completes the pipeline investigation tusk while it is at working weight. This empowers pipelines review without decreasing pipeline weight or suspends the whole pipeline system. The examined signals exchanged from the ultrasonic devices are digitized, compacted by information processors to a reasonable sum and put away in hard plate for disconnected examination (Yu *et al.*, 2005). A self-governing pipeline robot is created to accomplish the finding absconds tusk which receives the method for recognizing circumference welds joined with odometer wheels to find the deformities position, so, the issue of finding imperfections in early seaward pipelines unequipped with attractive markers is fathomed (Reber *et al.*, 2002). Clearly, the size welds of seaward pipelines assume the part of attractive markers for the new pipeline upkeep strategy. Investigation of Enhanced Oil Recovery (EOR) Surfactants on Clay Mixed Sandstone Reservoirs for Adsorption (Julius *et al.*, 2015).

Experimental study on nonionic surfactants for minimizing surface adsorption as an Improved Oil Recovery (IOR) process (Prince, 2014).

MATERIALS AND METHODS

On-line ultrasonic inspection pig: Attractive and ultrasonic techniques are the most regularly used to distinguish metal misfortune and breaking of pipelines. The real favorable position of ultrasonic strategy is the capacity, not at all like attractive flux spillage technique to give quantitative estimations for example, augmentation and profundity of the deformities with the exactness of mm. The ultrasonic canny assessment pig incorporates five segments: fluid driver, system controller, control supply, ultrasonic investigation device and ultrasonic information processor. The hardware incorporate PC/104 or more microcomputer, hard circle and information gaining sheets. The four barrel shaped lodges are additionally associated via. airproof hosepipes that electric power link and information transmission wire lies in. The fluid transmitted by pipelines drives the investigation pig prepare, the speed of which is controlled by the transmission weight as shown in Fig. 1.

Ultrasonic inspection tool: The ultrasonic review device that contains 64 ultrasonic transducers which work in time succession, one whirlpool current sensor and a few ecological sensors. Every one of these transducers are isolated into two gatherings with 32 transducers for each gathering and routinely stumbled to guarantee full circumferential scope of the pipe (Fig. 2).

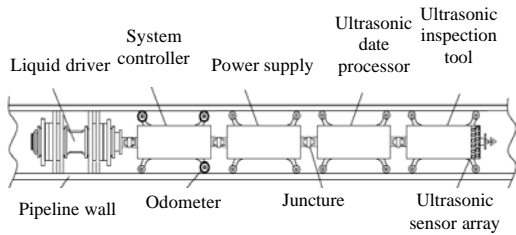


Fig. 1: Structure of ultrasonic inspection

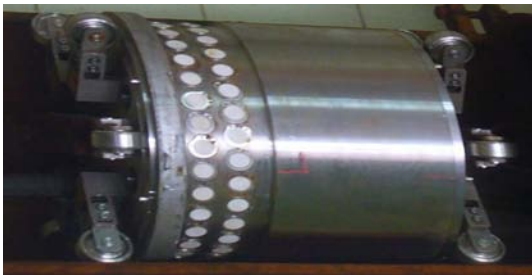


Fig. 2: Ultrasonic online inspection tool

Other than the 64 ultrasonic transducers, one moistness sensor, one temperature sensor and one weight sensor are likewise settled in this apparatus to gather the working natural information of the transducers which is utilized to adjust for the gained ultrasonic output information, later.

Ultrasonic data processor: In this component, the ultrasonic scan analog outputs transferred from the ultrasonic inspection tool are AD-converted, compressed by data processors and stored in hard disk. In the process of data compression, arithmetic coding and Huffman coding are adopted and the data compression percentage is 30% without any distortion. The ultrasonic data and odometer data transferred from system controller are stored with uniform time. The stored data can also be directly uploaded into a desktop or laptop PC for visualization or off-line analysis.

RESULTS AND DISCUSSION

On-line location process with robot: The early equipment of the wise pig utilized isotopes for following the pig prepare and finding the deformities. The limitation being used of isotopes, joined with their constrained capacity of finding accuracy, prompted the advancement of a self-ruling pipeline robot furnished with Ultra Low Frequency (ULF) electromagnetic wave producer. The ULF flag has the trademark to infiltrate through metal pipe, bed load and seawater (Reber *et al.*, 2002). In the



Fig. 3: Pulse generated when passing the grith weld

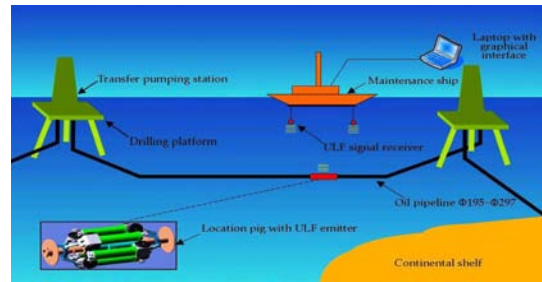


Fig. 4: Overview of online location process

venture, ULF electromagnetic wave plays out the through-shield unidirectional remote correspondence work. The independent pipeline robot has the comparable structure to the review pig appeared in Fig. 3.

The distinctions are that the fluid driver is supplanted by electric crawler and engine actuator, ULF producer is included which is additionally set in tube shaped impenetrable lodge and the power supply incorporates four lodges for expanded electric power.

Experiment: With the experiment pipeline system, on-line inspection experiments are carried out and water is used as medium. The acquired ultrasonic data are used to extract defect characters and perform automatic defect findings. Experimental results show the defect whose area is more than $10 \times 10 \text{ mm}^2$ can be detected, measurement error of the pipe's thickness is $< 0.5 \text{ mm}$ and the defect which affects safe operation can all be identified while defect's damage degree is overrated sometimes. So, the defect's character extraction and defect assessment strategies are effective (Fig. 4).

CONCLUSION

The arrangement of types of gear are created going for keeping up early-fabricated seaward oil pipelines

generally unequipped with attractive markers. The issue of finding deformities is splendidly illuminated with size welts, assuming the part of position check, rather than the attractive markers. The examination pig which has a moderately succinct plan and minimal effort addresses early-manufactured pipelines issue of occasional investigation to protect safe run. At the point when imperfections emerge, the self-governing pipeline robot is utilized to complete the finding abandons tusk. From the arrangement of types of gear's working standard, clearly, they are equipped for recently constructed seaward oil pipeline's and additionally inland oil pipelines upkeep.

REFERENCES

- Can, F.H., Z. Xue-Nian and C. Guo-Ming, 2001. Reliability evaluation of corrosion defect of the subsea pipeline. *Oil Field Equip.*, Vol.1,
- Gunarathne, G.P. and Y. Qureshi, 2005. Development of a synthetic A-scan technique for ultrasonic testing of pipelines. *IEEE. Trans. Instrum. Meas.*, 54: 192-199.
- Julius, P., P.N. Ananthanarayanan and V. Srinivasan, 2015. Investigation of Enhanced Oil Recovery (EOR) surfactants on clay mixed soils for adsorption. *Indian J. Sci. Technol.*, Vol. 8, 10.17485/ijst/2015/v8i14/70695
- Nicolas, B., J. Mars, J.L. Lacoume and D. Fattaccioli, 2002. Are ultra low frequency waves suitable for detection?. *Proceedings of the 2002 MTS-IEEE Conference on OCEANS'02 Vol. 2, October 29-31, 2002, IEEE, Biloxi, Mississippi, USA.*, ISBN:0-7803-7534-3, pp: 1109-1113.
- Prince, M.J.A., 2014. Experimental study on nonionic surfactants for minimizing surface adsorption as an Improved Oil Recovery (IOR) process. *Indian J. Sci. Technol.*, 7: 78-81.
- Reber, K., M. Beller, H. Willems and O.A. Barbian, 2002. A new generation of ultrasonic in-line inspection tools for detecting, sizing and locating metal loss and cracks in transmission pipelines. *Proceedings of the IEEE Symposium on Ultrasonics Vol. 1, October 8-11, 2002, IEEE, Munich, Germany, ISBN:0-7803-7582-3, pp: 665-671.*
- Yu, J., J.G. Lee, C.G. Park and H.S. Han, 2005. An off-line navigation of a geometry PIG using a modified nonlinear fixed-interval smoothing filter. *Control Eng. Pract.*, 13: 1403-1411.