



Ultrasonic Tomography for Potential Oil and Gas Pipeline Imaging



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Introduction

Ultrasonic Tomography has the advantage of imaging two-component flows and gives the opportunity of providing quantitative and real-time data on cross-section images within a full-scale industrial process.

The major potential benefits are, it is possible to gain an insight into the actual process. The overall anticipated effects are improvements in product yield and uniformity, minimized input process material, reduced energy consumption and environmental impact and lowering occupational exposure to the plant personnel.

Aim

In this study we carried out a tomographic investigation on a column using ultrasonic sensor and provides real-time imaging.

Materials & Methods

The ultrasonic sensor used in this setup has resonance frequency of 335 kHz. Figure 1 shows the sensor arrangement which consists of 32-ultrasonic sensor that is mounted on a process column non-invasively.

Each sensor has transmit and receive ultrasonic signal capability. When a sensor acts as a transmitter, it projects ultrasonic wave in a fan-shaped beam manner with a beam angle of 95 degrees and views 17 sensors (act as receiver) at the opposite direction as shown in Figure 1

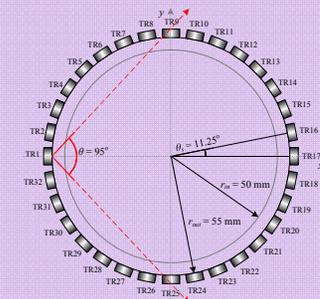


Figure 1. Sensor array arrangement

Results & Discussion

Figure 2 shows the test profile dimensions and its position in experimental column. The data was collected, and the tomography images were reconstructed using a Linear Back-Projection (LBP) technique.

Conclusion

The non-invasive ultrasonic tomography for liquid/gas two-phase flow had been developed and investigated. The experimental results showed that this system could be used to identify the flow pattern and measure the cross-sectional void fraction

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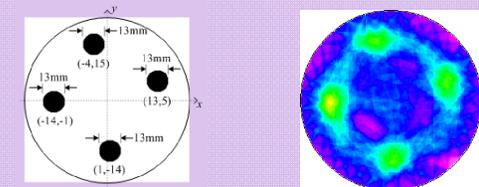


Figure 2. Test Profile and its Tomogram

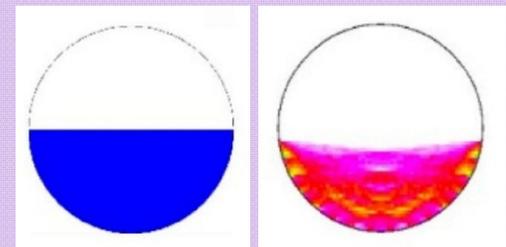


Figure 3. Horizontal flow and its Tomogram