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# Study on the Ultrasonic Propagation Law in Gas-Liquid Two-Phase Flow of Deep-Water Riser Annulus

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In order to achieve gas kick early detection outside the riser, the ultrasonic propagation law in gas-liquid two-phase flow of riser annulus need to be analyzed. Therefore this paper aims to explore the ultrasonic propagation law in gas-liquid two-phase flow of riser annulus under different conditions and to establish a quantitative relationship between the ultrasonic signals and gas void fraction.
1.The theoretical model of ultrasonic propagation in gas-liquid two-phase flow of riser annulus was established, which was used to analyze the ultrasonic propagation law preliminarily.
2.The experimental device of ultrasonic gas kick monitoring outside the riser was designed, and the ultrasonic signal responses under different conditions (such as probe installation method, void fraction, drill pipe eccentric degree, etc.) were analyzed.
3.The ultrasonic propagation law in gas-liquid two-phase flow of riser annulus was analyzed by using numerical simulation method. The reliability of numerical simulation method established was confirmed by comparing with the experimental results.
Through comparing the theoretical analysis, experimental and numerical simulation results, the reliability of experimental methods and numerical simulation model established in this paper were verified. Therefore the experimental device and numerical model in this paper could be used to study the ultrasonic propagation law in gas-liquid two-phase flow of deep-water riser annulus. On this basis, the mounting position and transmission frequency of ultrasonic probes were optimized. Meanwhile, the gas void fraction sensitive parameters of ultrasonic such as sound amplitude and speed were selected. Through further studies, the calculation model of comprehensive sensitive parameters was founded, and the quantitative relationship between ultrasonic characteristic parameters and gas void fraction under different conditions was established based on a large number of experiments and numerical simulations.
In this paper, the quantitative relationship between ultrasonic characteristic parameters and gas void fraction under different conditions was established. It provided a theoretical and technical support for the gas kick quantitative monitoring in deep-water riser by using ultrasound. On this basis, the riser gas kick early detection equipment (R-GED) is being developed, which is expected to achieve gas kick quantitative monitoring and even accurate determination of the degree of bottom hole gas kick.

## References

## Acceptance of Terms and Conditions

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