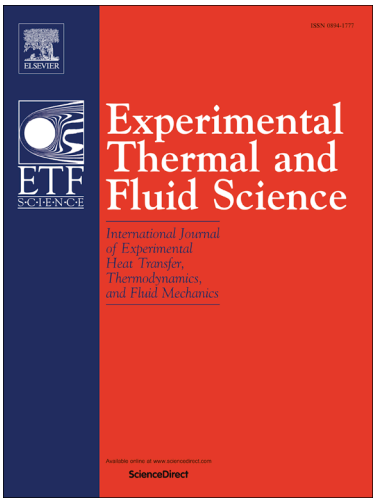

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PII: S0894-1777(18)30341-8
DOI: https://doi.org/10.1016/j.expthermflusci.2018.09.017
Reference: ETF 9613

To appear in: *Experimental Thermal and Fluid Science*

Received Date: 6 March 2018
Revised Date: 9 August 2018
Accepted Date: 25 September 2018

Please cite this article as: Y. Pan, C. Li, Y. Ma, S. Huang, D. Wang, Gas flow rate measurement in low-quality multiphase flows using Venturi and gamma ray, *Experimental Thermal and Fluid Science* (2018), doi: https://doi.org/10.1016/j.expthermflusci.2018.09.017

Gas flow rate measurement in low-quality multiphase flows using Venturi and gamma ray

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Abstract

Online flow rate measurements are encountered in many areas with a great need for high accuracy, especially in low-quality (0-0.1) flows. This paper concerns gas flow rate measurements using a Venturi meter and gamma-ray attenuation technique. A linear correlation is developed to predict the gas flow rates with wide ranges of void fractions (0~95%). The correlation predictions were compared to experimental data in which the root mean square errors of the oil-air-water multiphase flow prediction results are 7.72%, 8.93% and 9.11% for the gas flow rate, the quality and the gas-liquid slip ratio, respectively. The effect of the Venturi size was tested, and the metering accuracy is found to increase with the inlet diameter. The prediction accuracy is improved for three-phase flows than for the corresponding two-phase flows due to the oil-water stirring in the three-phase flows. The analyses of the results indicate that the measurement accuracy is higher with stable flow regimes than intermittent flow regimes. The present method can be widely applied to both two-phase and three-phase flows in the oil industry even for different Venturis and fluid media.

Keywords：multiphase flow, Venturi meter, gamma ray, gas flow rate, flow regime