Some critical comments about “Operation features of a narrowing device in separationless three-phase flowmeter” by Yu. P. Filippov and A. Yu. Filippov published in *Flow Measurement and Instrumentation* 68 (2019) 101578.

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ABSTRACT

The experimental data or analysis presented by authors in the paper “Operation features of a narrowing device in separationless three-phase flowmeter” by Yu. P. Filippov and A. Yu. Filippov published in Flow Measurement and Instrumentation 68 (2019) 101578 break the second law of thermodynamics. We would like to pointed out to these aspects in the paper.

I. CRITICAL COMMENTS

The authors’ approach gives the negative values for the pressure losses due to friction (ΔP_{fr}) in some volumetric gas content (β) ranges (Figures 4, 6, 8). Authors attribute this to the hydrodynamic crisis – the phenomenon when pressure drop (ΔP) of two-phase flows in the channel can decrease as β raises. But this explanation is not valid, because during such decrease of pressure drop, the value of ΔP_{fr} must always stay greater than zero. In other case, it would broke the second law of thermodynamics [1, 2].

By definition, the value of volumetric gas content must always satisfies the condition: $0 \le \beta \le 1$. However, the Eq. (11) gives values less than zero at $\beta_\gamma \le 0.86\%$ and greater than one at $87\% \le \beta_\gamma \le 99.6\%$ which indicates the incorrectness of the interpolation formula (11).

Authors fit the experimental water cut data by cubic polynomial (Fig. 9, Eq. 12). Because of good mixing of water and Exxsol there is no any physical reason to expect deviations from the linear law $w=w_\gamma$. They do not substantiate why they chose cubic polynomial for fitting, but neither

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quadratic nor biquadratic one (both have about the same goodness of fit as cubic).

CONCLUSIONS

It follows from the above that the approach proposed by authors to determine characteristics of narrowing device for three-phase flows are not acceptable.

References

1. Planck M. Treatise on Thermodynamics. Longmans, Green and Co., London, New York and Bombay, 1903.
2. Truesdell C., Muncaster R.G. Fundamentals of Maxwell's Kinetic Theory of a Simple Monatomic Gas, Treated as a Branch of Rational Mechanics. Academic Press, New York, 1980.