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Peer Review

Review of: "Detecting Turbulent Patterns in Particulate Pipe Flow by Streak Angle Visualization"

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Paper Title: Detecting Turbulent Patterns in Particulate Pipe Flow by Streak Angle Visualization

Summary:

The paper presents a novel, cost-effective method for capturing flow patterns—laminar flow, laminar-to-turbulent transition, and turbulent flow. Its primary contribution lies in the experimental investigation of using particles with a Stokes number close to 1 to identify these flow regimes through image processing technology. The predictions of this new method are compared against those of particle image velocimetry (PIV), demonstrating that streak angle visualization can accurately identify flow patterns.

Research Gap:

Existing experimental methods for identifying flow characteristics are influenced by the coexistence of the solid and liquid phases, which can introduce uncertainties in the results.

Research Methodology:

An experimental setup was designed to collect particle movement data in the flow using both PIV and streak angle visualization techniques.

Importance of the Research:

This study develops a simple, effective, and cost-efficient method for capturing flow characteristics, which could have significant applications in fluid dynamics research and industrial processes.

Novelty of the Paper:

An experimental device was developed to collect flow data and identify flow characteristics.

A statistical method was employed to analyze the experimental data.

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Weaknesses of the Paper:

The paper states: *"The main question is whether their trajectories display turbulent features (i.e., erratic, misaligned) when the fluid phase is turbulent and laminar (i.e., rectilinear and aligned in the streamwise direction when the fluid phase is laminar)."* However, the logic here is not sufficiently robust. Since the particles have a Stokes number close to 1, their inertial forces compete with the forces exerted by the flow. Even if the particles exhibit erratic movement, this may not necessarily be caused by the flow itself. For instance, in a bent pipe, particles might appear erratic due to collisions with the wall, which could further disturb the flow. The study needs to clarify whether the flow characteristics can be accurately represented by the particle streaks or if the results are coincidental due to the experimental setup.

In the initial image processing step, the background frame is subtracted from the raw image to eliminate interference. This background frame is generated by averaging all frames captured during the experiment. However, this process might inadvertently remove important information from the raw data. The authors should address whether this step could lead to the loss of critical flow-related details.

The physical phenomenon represented by the streaks in the images is not clearly explained. Are these streaks associated with the way particles are released into the flow? A more detailed explanation of the underlying physics would strengthen the paper.

The use of tracers in the experiment seems redundant. Since the tracers are small enough, the particulate flow should exhibit the same characteristics as a pure flow. The authors should clarify the necessity of including tracers and explain their role in the study.

Some minor issues:

1. Abstract: Because ~~of~~ it is.....
2. Page 5: In detail in [53]. Please check.
3. Page 6: 1.2 m ±10 μm. Check the unit μm.

Recommendation:

After considering these factors, the paper is recommended for revision before acceptance. Addressing the above concerns will enhance the clarity, robustness, and scientific rigor of the study.

Declarations

Potential competing interests: No potential competing interests to declare.