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Invention Title	COMPUTATIONAL FLUID DYNAMICS ANALYSIS OF FULLY SUSPENDED SLURRIES IN HORIZONTAL PIPES WITH A FLOW CASE STUDY
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Abstract:

Abstract This work provides an in-depth CFD investigation of fully-suspended slurries in horizontal pipes. It is an essential part of many industrial processes including processing, wastewater treatment, and mining. The primary focus is on understanding the complex dynamics of slurry flow, which is pivotal for optimizing pipeline de ensuring efficient, cost-effective operations. Utilizing advanced CFD techniques, the research investigates the behaviour of slurries characterized by different particle densities, and concentrations, flowing through stainless steel pipes (Grade 316) under a range of operational conditions. The CFD model, developed using the finite vo method (FVM), is grounded on the Navier-Stokes equations, incorporating turbulence models and a discrete phase model for particle tracking. The effects on flow pat velocity profiles, and pressure drops of changing factors like flow rate, slurry concentration, particle size, and pipe diameter are studied in detail in this work. The simu findings provide important information about the changes in flow regimes, the quality of the particle suspension, and the patterns of erosion inside the pipe. Key finc the identification of laminar-turbulent transition points, the influence of particle size on suspension and wear, and the non-linear relationship between flow rate and drop. These results are instrumental in highlighting the importance of tailored slurry and pipeline specifications for different industrial scenarios. The study also comp CFD results with existing empirical data, demonstrating a high degree of correlation and thus validating the model's accuracy. This research contributes significantly t fluid dynamics by providing a deeper understanding of slurry flow behaviour in horizontal pipes. The findings offer valuable guidelines for the design and optimizatio transportation systems, aiming to enhance operational efficiency and reduce maintenance costs in industrial processes involving slurry transport.

Complete Specification

Description:Computational Fluid Dynamics Analysis of Fully Suspended Slurries in Horizontal Pipes with A Flow Case Study

Field and Background of the Invention

Many industrial processes could benefit greatly from more research into totally suspended slurries in horizontal pipelines. It is an important subfield of fluid dynam mining, wastewater treatment, and chemical processing industries frequently make use of slurries, which are mixes of liquids and solids. Understanding the behavi these slurries during transport is essential for efficient and safe pipeline design. One of the primary challenges in transporting slurries is maintaining the suspensio particles. This is crucial to prevent settling, which can lead to pipe blockages and increased wear due to abrasion. The big challenge is compounded due to the lack gravitational assistance in keeping particles suspended in horizontal pipes. Further, the flow dynamics become more complex, with factors such as particle size, de and concentration playing significant roles. The flow of slurries in pipes is typically non-Newtonian, meaning that the fluid does not follow Newton's law of viscosity. non-Newtonian behaviour adds another layer of complexity to the analysis and design of slurry transportation systems. Therefore, a comprehensive understanding flow characteristics of fully suspended slurries in horizontal pipes is essential for optimizing pipeline design, reducing maintenance costs, and improving operationa efficiency.

Slurry flows extensive research has been conducted, focusing on aspects such as rheology, pressure drop, and wear. CFD has emerged as a powerful tool for studyi flows, providing detailed insights that are often difficult to obtain through experimental methods alone. However, there are still significant gaps in the literature, pa concerning fully-suspended slurries in horizontal pipes Most existing studies have concentrated on vertical or inclined pipes, where gravity assists in maintaining

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