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Computational Fluid Dynamics Analysis of Cyclone Separator Performance Using Discrete Phase Model

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Abstract : Cyclone separators are crucial components in various industries tasked with efficiently separating particulate matter from gas streams. Achieving optimal performance hinges on a deep understanding of flow dynamics and particle behaviour within these separators. In this investigation, Computational Fluid Dynamics (CFD) simulations are conducted utilizing the Discrete Phase Model (DPM) to dissect the intricate flow patterns, particle trajectories, and separation efficiency within cyclone separators. The study delves into the influence of pivotal parameters like inlet velocity, particle size distribution, and cyclone geometry on separation efficiency. Through numerical simulations, a comprehensive comprehension of fluid-particle interaction phenomena within cyclone separators is attained, allowing for the assessment of separation efficiency across diverse operational conditions and geometrical setups. The insights gleaned from this study promise to advance our understanding of the complex interplay between fluid and particle within cyclone separators, thereby enabling optimization across a wide array of industrial applications. By harnessing the power of CFD simulations and the DPM, this research endeavours to furnish valuable insights for designing, operating, and evaluating the performance of cyclone separators, ultimately fostering greater efficiency and environmental sustainability within industrial processes.

Keywords : cyclone separator, computational fluid dynamics, enhancing efficiency, discrete phase model
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