Novel Hydrocyclones for Minimal Erosion

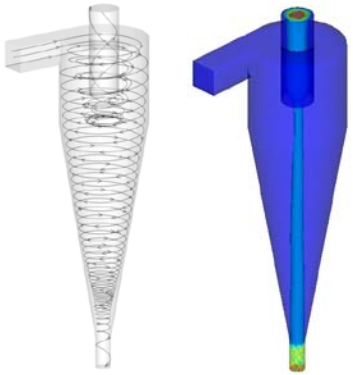
Hydrocyclone: Fundamental and Application

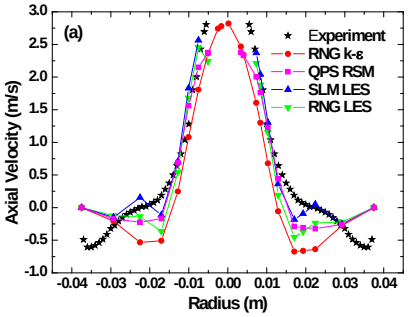
The hydrocyclone is a mechanical separation device which is used widely in mineral processing. The solid particles in mineral slurries are separated according to their density, size and shape by the centrifugal force generated by an induced vortex motion in a cylinder-on-cone vessel.

The objective of this project is to use the computational fluid dynamic (CFD) technique to model the turbulent swirling flow and predict regions of significant wear and how they are influenced by design of the inlet ducting. Novel hydrocyclone designs are proposed form lower operating energy costs and minimal erosion.

Mathematical Mdel

A 3D mathematical model of the hydrocyclone is developed to study turbulent flow and track particle separation as well as predict wear distribution on the inner wall of hyrdocyclone. Different geometrical designs are tested to explore better performance, especially for minimal erosion



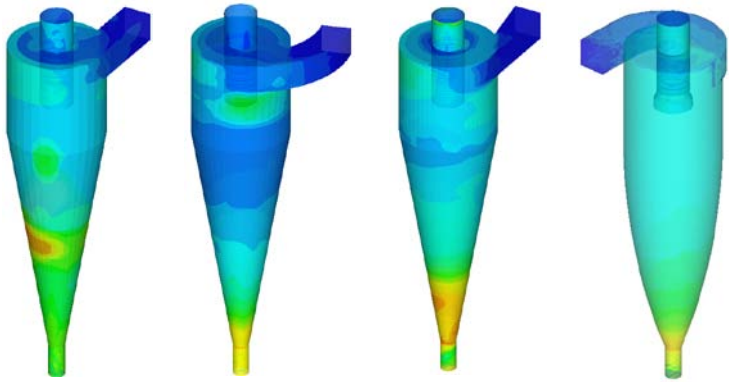


Fluid Flow and Air Core Prediction

The numerical results clearly indicates swirling flow pattern, and splitting overflow and underflow in hydrocyclone. The predicted axial and tangential velocities are close to experimental results. A nearly parabolic shape of the air core is well predicted, which agrees well with the experimental data.

Particle Tracking

The Lagrangian DPM follows the Euler-Lagrange approach. The fluid phase is treated as a continuum by solving the time-averaged Navier-Stokes equations, while the dispersed phase is solved by tracking a large number of particles through the calculated flow field.



Erosion Rate

Obvious hot spots can be found at the intersection of the cylindrical and conical sections and the middle part of conical section in the standard hydrocyclone. Novel hydrocyclones with different geometry indicate better performance and reduced erosion.

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