A Robust Model for a Hydrocyclone: Methodology and Application

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This study investigates the consistent and reliable simulation of a hydrocyclone. We focus on the solution methodology necessary. Two critical factors are delineated for the accurate prediction of hydrocyclone performance. The first point is domain discretization. It is found that mesh size and type strongly influences the solution. Hexahedral elements aligned with the flow direction give the best results. The second point concerns the solution algorithm. The most stable solutions result when the pressure and velocity profiles are initialized correctly. This procedure requires that a solution be generated first using single phase simulations, starting with the steady state solution, and being followed by a period of transient operation. Secondly, the air core must be established using a transient two phase simulation, with the results of the single phase runs as the starting point. The existence of a stable air core is absolutely critical. Finally, simulations involving particles are performed. In addition to these two key aspects, we also note that the use of the LES turbulence model is essential. Using this solution procedure enabled the modelling of two hydrocyclones, with superior agreement being found between simulated and observed results. Good agreement is obtained between experiment and prediction in both cases. Finally, particle separation efficiency is studied for two cases. In the first case, particles with the same density but different sizes were used, and in the second, uniformly sized particles with two different densities were used. Good agreement between experiment and prediction were obtained.