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Investigation of the Operational Principle and Flow Analysis of a Newly Developed Dry Separator

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Abstract : Mineral product, waste concrete (fine aggregates), waste in the optical field, industry, and construction employ separators to separate solids and classify them according to their size. Various sorting machines are used in the industrial field such as those operating under electrical properties, centrifugal force, wind power, vibration, and magnetic force. Study on separators has been carried out to contribute to the environmental industry. In this study, we perform CFD analysis for understanding the basic mechanism of the separation of waste concrete (fine aggregate) particles from air with a machine built with a rotor with blades. In CFD, we first performed two-dimensional particle tracking for various particle sizes for the model with 1 degree, 1.5 degree, and 2 degree angle between each blade to verify the boundary conditions and the method of rotating domain method to be used in 3D. Then we developed 3D numerical model with ANSYS CFX to calculate the air flow and track the particles. We judged the capability of particle separation for given size by counting the number of particles escaping from the domain toward the exit among 10 particles issued at the inlet. We confirm that particles experience stagnant behavior near the exit of the rotating blades where the centrifugal force acting on the particles is in balance with the air drag force. It was also found that the minimum particle size that can be separated by the machine with the rotor is determined by its capability to stay at the outlet of the rotor channels.

Keywords : environmental industry, separator, CFD, fine aggregate
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