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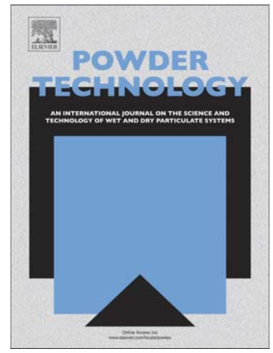

Study the effect of vibration frequency and amplitude on the quality of fluidization of a vibrated granular flow using discrete element method

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Abstract

A granular media can be fluidized by using an injected fluid flow or vibration of its container. Different factors affect the quality of fluidization in both cases such as fluid density and viscosity, particle size and coefficients of restitution and friction. In the bubbling fluidization, the air flow velocity is a determining factor while in the vibrational fluidization, the frequency and amplitude of vibration should be effective. In the present study, it was of interest to quantitatively evaluate the degree of fluidization of a granular flow within a reservoir vibrated vertically with different frequencies and amplitudes. Discrete element method was used to model the fluidized granular media. The bouncing flow mode was observed in the beds with low vibration frequencies, while the flows developed in the beds shaken with high frequencies revealed undulations (waviness) near their bottom walls and abrupt jumps at their free surface. Average velocity of particles was calculated within three boxes at top, middle and bottom of the bed to study fluidization of particles adjacent to the bottom vibrating wall and at the bed free surface. It was found that the average velocity of particles inside the granular flow decreased as the vibration frequency increased. However, increasing the vibration amplitude resulted in the particles average velocity increase due to the larger kinetic energy of the fluidized bed. Therefore, it was concluded that increasing vibration amplitude in processes such as mixing, segregation and vibratory finishing would be more efficient than increasing vibration frequency for fluidization. It was found that this conclusion is in agreement with some previous experimental findings. Furthermore, the average packing fraction was studied throughout the media vibrated by different frequencies and amplitudes to explain how the media was fluidized.