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| Title | Analysis of dynamic interactions in a bubble-particle system in presence of an acoustic field | | |
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| Abstract |  |
| Use of an acoustic field in [flotation](https://www.sciencedirect.com/topics/chemical-engineering/flotation) is known to improve mineral recovery. However, studies in this area are rather limited and in general there is a lack of a mechanistic description of the collision and collection efficiency of particles in presence of an external acoustic field. This study aims to contribute to this knowledge gap by developing a simplified 3D numerical model of single bubble-particle interactions based on a [discrete element method](https://www.sciencedirect.com/topics/earth-and-planetary-sciences/discrete-element-method) (DEM) based approach. Volume mode oscillatory behaviour of the bubble was modelled within the theoretical spherical shape limit (0.1 ≤ Bo ≤ 0.5) using 1D Rayleigh-Plesset equation in a quiescent liquid medium and one-way coupled to particle motion obtained through DEM. Interaction dynamics were simulated for various operating conditions involving three parameters, namely oscillation amplitude ratio (ε ≤ 0.1), excitation frequency (below and above resonance frequency) and bubble-particle surface-to-surface distance (∼1.0 to 10.6% of bubble radius). Regime maps were constructed to establish suitable combinations of these three operating parameters to represent the collision and attachment behaviour of a particle with the oscillating bubble. While conventional [flotation](https://www.sciencedirect.com/topics/chemical-engineering/flotation) models predict [particle collision](https://www.sciencedirect.com/topics/earth-and-planetary-sciences/particle-collision) efficiency based on the nearest streamline adjacent to the bubble surface, application of an acoustic field on a bubble was shown to incur collision with a particle in the far field away from the interface due to oscillatory motion. It was noted that although such collisions occurred in the below-resonance-frequency regime (∼35 to 79 Hz), particle attachment did not occur due to weakening of the attractive capillary force. In the above-resonance-frequency regime (3.61–14.4 kHz), however, particle attachment was predicted and attachment probability increased in the vicinity of the bubble resonance frequency. | |