Title Numerical Simulation of the Shaking Separation of Paddy and Brown Rice using the Discrete Element Method

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Abstract

Shaking separation of paddy and brown rice is investigated using a numerical model and by experiment at the same scale. The numerical model employs the discrete element method with two-dimensional circular particles representing rice grains. The indents on the experimental separation plate were modelled using a method of 'virtual' walls whereby only particles in contact with the base of the separation plate were affected by the walls which were positioned at regular intervals along the base. Exit of a particle from an indent was modelled as removal of a virtual wall once the particle-wall contact exceeded a threshold value. The model was validated against experimental results at the macroscopic scale in terms of mean particle distance from the sides and base of the separation plate, and the free surface profile. Particle movement in the experiments was tracked using a high speed video camera. There was good agreement between the results of the simulation and the experiment. The time required to achieve maximum separation of brown and paddy rice was the same in both experiment and simulation. The simulation also showed the same wave-like behaviour of the grain assembly as in the experiment.