Agglomeration Process of Wet Granular Material: Effects of Size Distribution and Froude Number
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Granular material flow & granule growth in the steel making. Such as pellets or granules. Iron ore granulation is an important stage in granulation in a horizontal rotating drum. In this work, we use Molecular Dynamics (MD) method to simulate the agglomeration process during the dense granular flows in the rotary drum. In which particles are distributed by an uniform distribution of particle volume fractions.

**OBJECTIVES & METHODOLOGY**

We investigate the agglomeration process of solid particles in the presence of a viscous liquid. We are mostly interested in application to iron ore granulation in a horizontal rotating drum. In this work, we use Molecular Dynamics (MD) method to simulate the agglomeration process during the dense granular flows in the rotary drum. In which particles are distributed by an uniform distribution of particle volume fractions.

**MOLECULAR DYNAMICS METHOD**

\[ m \frac{d^2 \mathbf{r}_i}{dt^2} = \sum (f_{ij} + f_{visc}) \mathbf{n}_i + f_i(t) + m_i g \]

- \( f_{ij} \): force between particles \( i \) and \( j \)
- \( f_{visc} \): viscous force
- \( m_i \): mass of particle \( i \) (kg)

**CAPILLARY cohesion & viscous force**

\[ F_{visc} = \frac{3}{2} \rho R^4 \left( \frac{1}{R_i} \right)^{\frac{1}{3}} \frac{dR_i}{dt} \]

- \( R_i \): particle radius
- \( \rho \): density of liquid
- \( \gamma \): surface tension

Diagram of capillary bridge

**AGGLOMERATION RESULTS**

- Exponential increase of wet & contact coordination numbers (a) and decrease of kinetic energy normalized by potential energy of granule (b), as functions of size ratio \( \alpha \).

**Further Researches**

- Investigation the agglomeration process of a huge number of particles.
- Comparison between experiment and simulation of agglomeration processes in rotating drum.

**References**

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