

SOUND SIMULATION OF GRANULAR MATERIALS

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Motivation

- Common pattern in sound simulation methods:

Visual simulation → Results → Sound simulation

- Follow the pattern also for granular materials?
- Previous work in sound simulation of granular materials: limited case scenarios only (footsteps, musical instruments, piles)

Background - sound of collisions

- Each collision produces two types of sound:
 - Ringing noise** from surface vibrations
 - Acceleration noise** from acceleration force
- Large objects: ringing noise **masks** their acceleration noise
- Small objects: ringing noise is **outside** human hearing range

Sound of granular materials

- We have identified sounds from two types of collisions:
- Particle vs. surrounding objects** – ringing noise of the large surrounding object prevails, acceleration noise is not significant
- Particle vs. particle** – ringing noise is outside the hearing range, acceleration noise is the only significant sound source

Our contribution

Result

- Sound simulation method for granular materials
- Physically based
- Handles general case scenarios that involve granular material
- Testing implementation to confirm the validity of the approach



Vis. simulation

Image: Ihmsen et al. 2013

Particle vs. surrounding objects

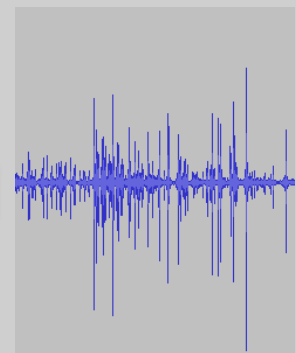
Collision data

Particle vs. particle

Ringing noise using modal analysis

Acceleration noise

Sound



Random collision data

- Not all visual simulation methods provide collision data
- Localized probabilistic approach towards generating collision data is proposed and tested

Visual simulation → Collision probability density approximation → Density sampling → Random collision data

Our contribution