

Title: Sound simulation of granular materials

Author: Matej Marko

Department: Department of Software and Computer Science Education

Supervisor: doc. Ing. Jaroslav Křivánek Ph.D., Department of Software and Computer Science Education

Abstract: In recent years, methods for simulating sounds of solid objects, fluids, fire and cloth have been developed. These methods extend existing methods for simulation of the visual behaviour of the respective phenomena and add physically based sounds that correspond with the visual information. The goal of this thesis is to investigate the possibility of creating a similar method for sound simulation of dry granular materials. We identified two distinct mechanisms responsible for the sounds of granular materials: the collisions of the particles of the granular material (**granular collisions**) and the collisions between the particles and a surrounding solid objects (**solid objects collisions**). We propose a method that uses acceleration noise to simulate the sounds of the granular collisions. The particles are approximated by a simplified spherical shapes. We also simulate the sound of the solid object collisions by using a modal analysis approach. Since most of the approaches to the visual simulation of granular materials do not provide the information about the particle collision, we also present a probabilistic approach to random generation of collision data.

Keywords: sound simulation, granular materials, modal analysis, acceleration noise