Geophysical Research Abstracts, Vol. 7, 01723, 2005
SRef-ID: 1607-7962/gra/EGU05-A-01723
© European Geosciences Union 2005

Spatial Tracking of a falling Rock using internal Acceleration Sensors

A. Volkwein

WSL Swiss Federal Institute for Snow and Avalanche Research SLF, Flüelastr. 11, 7260 Davos, Switzerland, volkwein@slf.ch

Rockfall is a persistent problem in Alpine areas, yet there are few detailed analyses of the interaction of the individual falling rocks and the protection measures. Until now, similar instrumented boulder instruments have not been usable in typical rockfall acceleration ranges on the order of $50\ g$. We report on the development and testing of an instrumented boulder for use in rockfall experiments, especially the interaction of individual rocks with flexible mitigation measures.

Due to the extremely short-term high acceleration peaks we use accelerometers integrated in an spherical boulder together with a computer control unit. Eight sensors measure the stone's deceleration over time. The number of sensors exceeds the minimum required number corresponding to the boulder's six degrees of freedom. This allows an analysis of imprecision and provides and a certain redundancy.
The boulder consists of fiber-reinforced high-performance concrete with a total mass of $825\ kg$. It can be dropped from heights of up to $32\ m$ withstanding impact decelerations of up to $100\ g$. The capacity sensors are sampled with $2\ kHz$. After triggering, the data are retained in the static RAM-memory until downloading is completed.
A time integration procedure similar to the central differences method used for finite elements gives the velocity and position of the rock from the measured deceleration. The algorithm shows an excellent description of the acting forces, but the integration over time has to be numerically amended.

Comparisons with high-speed video observations show that the instrumented boulder yields accurate observations of deceleration, suggesting that this technology could be applied to other geophysical flows such as debris flows or perhaps small-scale rock avalanches.