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Block ground interaction of rockfalls

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During a rockfall the interaction of the falling block with the ground is one of the most important factors that define the evolution of a rockfall trajectory. It steers the rebound, the rotational movement, possibly brake effects, friction losses and damping effects. Therefore, if most reliable rockfall /trajectory simulation software is sought a good understanding of the block ground interaction is necessary.

Today's rockfall codes enable the simulation of a fully 3D modelled block within a full 3D surface . However, the details during the contact, i.e. the contact duration, the penetration depth or the dimension of the marks in the ground are usually not part of the simulation.

Recent field tests with rocks between 20 and 80 kg have been conducted on a grassy slope in 2014 [1]. A special rockfall sensor [2] within the blocks measured the rotational velocity and the acting accelerations during the tests. External video records and a so-called LocalPositioningSystem deliver information on the travel velocity. With these data not only the flight phases of the trajectories but also the contacts with the ground can be analysed. During the single jumps of a block the flight time, jump length, the velocity, and the rotation are known. During the single impacts their duration and the acting accelerations are visible. Further, the changes of rotational and translational velocity influence the next jump of the block. The change of the rotational velocity over the whole trajectory nicely visualizes the different phases of a rockfall regarding general acceleration and deceleration in respect to the inclination and the topography of the field.

References:

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[2] Volkwein A, Klette J (2014) Semi-Automatic Determination of Rockfall Trajectories. Sensors 14: 18187-18210.