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An open source GIS-based tool to integrate the fragmentation mechanism in rockfall propagation

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Rockfalls are frequent instability processes in road cuts, open pit mines and quarries, steep slopes and cliffs. Even though the stability of rock slopes can be determined using analytical approaches, the assessment of large rock cliffs require simplifying assumptions due to the difficulty of working with a large amount of joints, the scattering of both the orientations and strength parameters. The attitude and persistency of joints within the rock mass define the size of kinematically unstable rock volumes. Furthermore the rock block will eventually split in several fragments during its propagation downhill due its impact with the ground surface. Knowledge of the size, energy, trajectory... of each block resulting from fragmentation is critical in determining the vulnerability of buildings and protection structures.

The objective of this contribution is to present a simple and open source tool to simulate the fragmentation mechanism in rockfall propagation models and in the calculation of impact energies. This tool includes common modes of motion for falling boulders based on the previous literature. The final tool is being implemented in a GIS (Geographic Information Systems) using open source Python programming.

The tool under development will be simple, modular, compatible with any GIS environment, open source, able to model rockfalls phenomena correctly. It could be used in any area susceptible to rockfalls with a previous adjustment of the parameters. After the adjustment of the model parameters to a given area, a simulation could be performed to obtain maps of kinetic energy, frequency, stopping density and passing heights.

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