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Numerical and experimental investigation of a rockfall drapery system

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Rockfalls represent a significant hazard to people and infrastructures in steep terrain, should it be a mountainous region, a quarry, or a mine. Although rockfall occurrences cannot be totally eliminated, it is possible to reduce the risk by deploying effective rockfall protective systems such as metallic wire mesh draperies.

This work focuses on the performance of a simple drapery system with a double-twisted hexagonal wire mesh. Numerical modelling and experimental investigations have been performed. The main objective of the work is the residual hazard assessment in conjunction with such a system since blocks can still detach between the installed drapery and the rock surface.

First, the numerical model for the drapery mesh and the rock slope is presented. Following the approach by Bertrand et al. [1], a discrete element model of a hexagonal wire mesh has been implemented into the open-source framework YADE [4]. The mesh is discretised by a set of spherical particles which interact remotely (i.e. interactions between the particles exist without direct contact) and are located at the physical nodes of the mesh. The rock slope is represented by triangular elements which have been generated on the basis of a point cloud representation of the rock slope. The slope is assumed to be rigid and energy dissipation on the slope during rock impact is considered via friction and viscous damping.

Second, results of field tests carried out at a mine in New South Wales (Australia) are presented [3]. Concrete blocks with shapes according to EOTA [2] were released from the top of a highwall. The tests were carried out on two different sections of the highwall: the first section had a drapery system installed whereas the second section had no protective system installed. In the first section, the blocks were released between the rock surface and the mesh drapery. The 3D block trajectories were recorded by using two stereo pairs of synchronised high speed cameras. The collected data has then been used to calibrate and validate the numerical model.

Finally, some remarks on the final residual hazard assessment will be given by showing some capabilities of the developed numerical model.

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