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Development of an innovative type of rock fall protection structure made of an assembly of geo-cells

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Among natural hazards occurring in mountainous regions, rockfalls are the most currently interacting with the human environment. Different type of protection structures can be designed to endure impact by boulders of energies up to 50,000kJ and beyond. For instance, dykes are commonly placed closed to the elements at risk to intercept and stop medium to high energy falling blocks.

In this context, an innovative approach consists in developing a composite deformable structure. The basic idea is to allow a certain damage level during the impact on an easy-to-restore structure. This implies concentrating the deformation on a predefined and accessible part of the structure.

Such a goal may be reached by developing a ‘sandwich structure’ made of an assembly of cells. These cells are wire netting cages filled with granular materials which characteristics are adapted depending on the place and function in the structure. The sandwich structure is indeed built with different type of cells, allowing the raising of different vertical layers.

The development of such a structure is based on a multi-scale approach strongly coupling experiments together with numerical modelling, under static and dynamic conditions.

The main concern here is to present the work undertaken, emphasizing the global method. Experimental investigations and numerical developments are presented, from the materials to the global structure. Finally, the numerical results allow demonstrating the advantages of such a type of structure in different situations.