2D AND 3D NUMERICAL DESIGN OF SNOW NET SYSTEMS

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ABSTRACT: The present study deals with snowpack motion and its interaction with a flexible snow supporting structure. The final aim of this research is to evaluate forces induced into a snow net system by its interaction with a snowpack. Thanks to this calculation, a better engineering design of these structures will be obtained.

A 3D model was developed to simulate the interaction between the snowpack and the net system. This model is based on the discrete element method. The snowpack is described by a set of rigid elements and the net system by a set of nodes, which can be either fixed (anchors and pile extremities) or mobile (inner part of the net). As a first approximation, the elements are rigid, and the settlement cannot thereby be taken into account during computation. Moreover, this description assumes that the snowpack movements are only in the direction of the main slope. The constitutive relation between snow elements is assumed to be viscous. The nodes of the net are linked with their closest neighbors by linear elastic forces. For a given snowpack geometry and density distribution, the obtained numerical equilibrium state corresponds to a particular time during winter. The evolution of the net structure during the whole winter requires performing a series of calculations, each of which takes into account the updated nivologic scenario.

Six anchors of a real structure were monitored at Flaine (French Alps) for several years. These measurements were used as first elements of validation for our model. A rather good agreement between the 3D model and measurements has shown the ability of our approach to simulate the efforts induced into a protection structure by the slow movements of the snow. However, the computation of the 3D model may be time consuming. This code could be also difficult to use in engineering practice. Consequently, a 2D representation, using the same descriptions for the snowpack and the snow net, was developed as a simplification in order to reduce the computation time. Comparisons between this 2D model and field measurements are now in progress in order to assess this simplified code.

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