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Structural vulnerability assessment using reliability of slabs in avalanche area

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Improvement of risk assessment or hazard zoning requires a better understanding of the physical vulnerability of structures. To consider natural hazard issue such as snow avalanches, once the flow is characterized, highlight on the mechanical behaviour of the structure is a decisive step. A challenging approach is to quantify the physical vulnerability of impacted structures according to various avalanche loadings.
The main objective of this presentation is to introduce methodology and outcomes regarding the assessment of vulnerability of reinforced concrete buildings using reliability methods. Reinforced concrete has been chosen as it is one of the usual material used to build structures exposed to potential avalanche loadings. In avalanche blue zones, structures have to resist to a pressure up to 30kPa. Thus, by providing systematic fragility relations linked to the global failure of the structure, this method may serve the avalanche risk assessment.
To do so, a slab was numerically designed. It represented the avalanche facing wall of a house. Different configuration cases of the element in stake have been treated to quantify numerical aspects of the problem, such as the boundary conditions or the mechanical behaviour of the structure. The structure is analysed according to four different limit states, semi-local and global failures are considered to describe the slab behaviour. The first state is attained when cracks appear in the tensile zone, then the two next states are described consistent with the Eurocode, the final state is the total collapse of the structure characterized by the yield line theory. Failure probability is estimated in accordance to the reliability framework. Monte Carlo simulations were conducted to quantify the fragility to different loadings. Sensitivity of models in terms of input distributions were defined with statistical tools such as confidence intervals and Sobol's indexes.
Conclusion and discussion of this work are established to well determine contributions, limits and future needs or developments of the research. First of all, this study provides spectrum of fragility curves of reinforced concrete structures which could be used to improve risk assessment. Second, the influence of the failure criterion picked up in this survey are discussed. Then, the weight of the statistical distribution choice is analysed. Finally, the limit between vulnerability and fragility relations is set up to establish the boundary use of our approach.