



## Numerical evaluation of the interaction domain for gypsum pillars

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The object of this work has been the evaluation of an interaction domain M-N-T for pillars located in an abandoned gypsum mine. The interaction domain is extremely useful for evaluating the limit failure when a pillar is simultaneously subjected to axial force N (from overburden loads) and to shear force T and momentum M (for instance seismic loads).

The existing joints across the pillar suggest to overpass a typical continuum approach. In order to consider the presence of cracks during numerical simulations, a hybrid method FEM/DEM, which allows the transition from continuum to discontinuum, was assumed. By means of a specific numerical code (ELFEN), this approach has been calibrated involving both physical quantities introduced by fracture mechanics and numerical aspects in order to support this hybrid method. Furthermore, the approaches FEM and FEM/DEM have been compared, showing advantages and disadvantages through experimental tests carried out to characterize geomechanical response of the pillar. The interaction domain has been calculated thanks to the implementation of both methods. The meaning of determining this domain is related to the evaluation of failure limit when a coupled system of loads (normal and tangential force and momentum) is acting on pillars. An application to a case study of an abandoned gypsum mine interacting with building in San Lazzaro di Savena (Bologna) will be shown.