Increasing performances of GEO3D, a 3D geomechanical code for underground storage cavern design and stability studies

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ABSTRACT :

The GEO3D software is the result of developments conducted by Gaz de France and the Paris School of Mines since 1993 in the field of three dimensional geomechanical modeling of underground works in rock salt. GEO3D is based on the finite element method and handles 2D or 3D structures made of materials involving elastic, elastoplastic as well as elastoviscoplastic behaviors.

When a finite element study is needed, a model has to be built that is both precise enough in order to accurately predict the mechanical phenomena and simple enough in order for the calculations to run efficiently. In many cases, two dimensional models fulfill these requirements. In many other cases, the hypotheses that have to be made in order to stay within a two dimensional framework are so strong that the finite element study is no longer representative. In such cases, three dimensional simulations are required.

Of course, three dimensional simulations are more difficult to deal with because they handle much larger models than classical two dimensional models. The difficulty is twofold :

- Building the model is more complicated in three dimensions. However, thanks to the development of adequate interface programs, GEO3D provides efficient tools for the construction of the most complicated three dimensional models.

- Running the simulations takes longer. However, on one hand computing speed almost doubles every two years. On the other hand, the numerical methods used in GEO3D have been improved over the past five years, speeding up the simulations by a factor which depends on the model (a value as high as 25 has been measured).

This poster displays the results of several three dimensional studies performed by Gaz de France on salt caverns. It illustrates the advances made in terms of computer time and outlines the main numerical improvements that led to such performances. The increasing efficiency of three dimensional geomechanical modeling opens a wider range of applications for the optimization of mining and underground storage operations.