Assessment of Rock Masses Performance as a Support of Lined Rock Cavern for Isothermal Compressed Air Energy Storage

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Abstract : In order to store highly pressurized gas such as an isothermal compressed air energy storage, Lined Rock Caverns (LRC) are constructed underground and supported by layers of concrete, steel and rock masses. This study aims to numerically investigate the performance of rock masses which serve as a support of Lined Rock Cavern subjected to high cyclic pressure loadings. FLAC3D finite different software is used for the simulation since the software can effectively model the behavior of concrete lining and steel plate with its built-in structural elements. Cyclic pressure loadings are applied onto the inner surface of the cavern which then transmitted to concrete, steel and eventually to the surrounding rock masses. Changes of stress and strain are constantly monitored throughout all the process of loading operations. The results at various monitoring locations are then extracted and analyzed to assess the response of the rock masses, specifically on its ability to absorb energy during loadings induced by the changes of cyclic pressure loadings inside the cavern. By analyzing the obtained data of stress-strain relation and taking into account the behavior of materials under the effect of strain-dependency, conclusions on the performance of rock masses subjected to high cyclic loading conditions are drawn.

Keywords : cyclic loading, FLAC3D, lined rock cavern (LRC), strain-dependency

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