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Innovation of giant NPR cable and its advantages in critical slip warning for landslide disaster

Dr. Chun Zhu (Hohai University, China)

Reconciliation between laboratory and in-situ measurement of elastic stiffness for Opalinus clay

Dr Lang Liu (University of Alberta, Canada)

29th July 2022 (12:00pm GMT)

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Dr. Wei Li (USA)

Coupled Thermo-Hydro-Mechanical Modeling of Radioactive Waste Disposal in Rock Salt

Dr. Hafssa Tounsi (France)

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Innovation of giant NPR cable and its advantages in critical slip warning for landslide disaster

Abstract

Precise monitoring and early warning of landslides are crucial for disaster prevention and mitigation. This talk introduces an improved remote monitoring and forecasting system for landslides. The proposed system uses Negative Poisson's ratio (NPR) cable to measure the Newton force. Based on the results of indoor experiments, it has been demonstrated that the NPR cables could maintain constant resistance, undergo large deformation of 2 m, and exhibit high energy absorption under the dynamic and static loading. These characteristics would prevent damages to monitoring cable with the large deformation of landslide, guaranteeing the effective monitoring and pre-warning for the whole process of landslide disaster.

In addition, the presentation will discuss the four warning modes and warning levels that were established using the massive Newton force field monitoring data. The critical slip warning time of 3.5-20 h could be realized. Currently, the system was implemented at 623 monitoring points around 23 provinces in China. 16 landslide disasters within the monitoring area have been successfully warned. More than 100 lives and hundreds of millions of equipment and property have been saved. The precision of critical slip warning for landslide disaster was further improved.

Speaker

Dr. Chun Zhu is currently working as the Professor at School of Earth Sciences and Engineering, Hohai University. Dr. Chun Zhu holds a MSc in Civil Engineering from China University of Mining and Technology (Beijing), and a Ph.D. in Geological Engineering from Jilin University, China. His research focuses mostly on the deep rock mechanics and engineering disaster monitoring.

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Reconciliation between laboratory and in-situ measurements of elastic stiffness for Opalinus Clay

Abstract

Opalinus Clay is a designated host rock for future radioactive waste disposal in Switzerland. Characterization of the elastic stiffness and its evolution is essential for prediction of ground deformation and active seismic monitoring during the construction and operation of disposal repositories. The determination of geomechanical properties of Opalinus Clay relies heavily on laboratory tests on small core specimens. To assess the in-situ elastic stiffness at a larger scale, pre-bored pressuremeter tests were performed in Opalinus Clay at the Mont Terri Rock Laboratory, with the testing probe oriented both perpendicular and parallel to the bedding planes. The shear modulus of the Opalinus Clay is determined using the unloading steps of the pressuremeter tests at multiple expansion pressure levels. When small-strain nonlinearity, elastic anisotropy, and the differences in shear modes and stress paths are taken into account, the shear modulus determined from pressuremeter tests is shown to be comparable with those measured from triaxial tests on the core specimens.

The observed evolution of the elastic stiffness along the triaxial testing stress path is modeled using a constitutive formulation proposed in this work, which also explains the dependence of the shear modulus on expansion pressures in the pressuremeter tests. The anisotropic borehole response from the pressuremeter tests in the borehole oriented parallel to bedding is further predicted using an analytical model with the anisotropic elastic parameters calibrated from the laboratory measurements. The prediction approximately agrees with the in-situ measurement but can be improved if the effect of the drilling-induced localized borehole damage is considered.

Speaker

Dr. Lang Liu has obtained his Ph.D. and MSc in Geotechnical Engineering from the University of Alberta (UAlberta) and his B.Eng. degree in Safety Engineering from the China University of Mining and Technology (CUMT). His research work varies from underground coal mining hazard prevention to petroleum and mining geomechanics. His work at UAlberta focuses on the application of pressure meter testing in shales and the development of interpretation methodology for in-situ stress and geomechanical properties. He is also experienced in laboratory characterization and constitutive analysis of weak rocks.