

[일반기사]

Report of Participation in the 3rd International Conference on New Development in Rock Mechanics and Engineering Sanya, P.R.China, May 24-26, 2009

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The first and second NDRM conference was held in 1994 and 2002, respectively, in Shen Yang, which is located in northeastern part of China. This time it moved to San Ya, a brand new and beautiful city in Hai Nan island of China. The conference was organized by Northeastern University and Chinese Society for Rock Mechanics and Engineering. Joint sponsors of this conference were San Ya Scientific Technical Committee, State Key Laboratory of Geomechanics and Geotechnical Technology, Institute of Rock and Soil Mechanics, Chinese Academy of Sciences, and Liberty Culture & Technology Company (USA).

Nearly seventy participants from 10 different countries took part in the 3rd NDRM conference.

The opening ceremony was attended by Prof. John Hudson who is the president of International Society for Rock Mechanics (ISRM), Prof. Yun-mei Lin, the Chairman of the conference, Prof. Qi-hu Qian, president of Chinese Society for Rock Mechanics and Engineering (CSRME) and academician of Chinese Academy of Sciences, Prof. Xia-ting Feng, ISRM president elect for 2011-2015. Prof. Bing-Jun Fu, who is the ex-secretary general of Chinese Society for Rock Mechanics and Engineering, presided the opening ceremony.

The chairmen of the plenary sessions were Prof. Nuno Grossmann (Portugal), Prof. Xia-ting Feng (China), Prof. Chung-in Lee (Korea), Prof. Chun-an Tang (China), Prof. Pawel Nawrocki (UAE), Prof. Bing-Jun Fu (China), Prof. Abdolhadi Ghazvinian (Iran), Prof. Wan-Cheng Zhu (China), and Prof. Ribeiro Sousa (Portugal).

The opening lecture was presented by John A Hud-

son on the topic of "Improving the process of developing new ideas and techniques for rock mechanics"

The other six keynote lectures were presented by Prof. A. Ghazvinian (Iran), Prof. Chun-An Tang (China), Prof. Ribeiro Sousa (Portugal), Prof. Pawel Nawrocki (UAE), Prof. Nuno Grossmann (Portugal), Prof. Seokwon Jeon (Korea). There were additional 16 lectures.

The topics of the conference including general problem and fundamental research, experimental techniques and field measurements, numerical analysis and computer simulation, rock mass engineering stability analysis, design, support and construction. The volume of conference proceedings comprises of selected 90 papers. The participants from civil, mining, geological, hydro-electrical engineering presented their new and pioneering analysis methods and practical applications of the new techniques. During the plenary sessions there were lots of discussion, exchanges of opinions and papers and many new contacts and plans for cooperation were made.

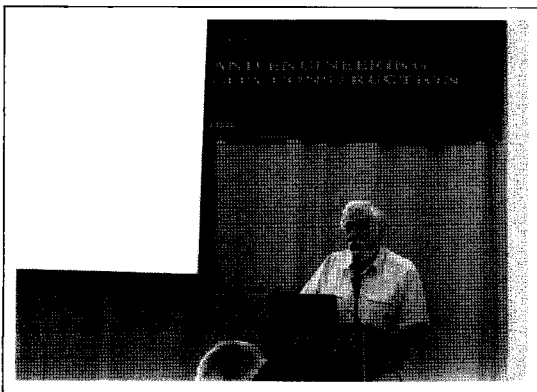
The conference was summarized by President ISRM) John Hudson. Finally, outstanding papers were selected. And two papers gave me deep impression. A brief introduction about these two are shown as follows.

The first one was "Numerical simulation on excavation-damaged zone (EDZ) in fractured rock mass under coupled thermal-hydraulic-mechanical conditions" by Prof. Wan-Cheng Zhu from Northeastern University of China. The excavation damaged zone is of great interest in the field of radioactive waste management and underground mining. It may provide a pathway for groundwater flow and potentially radionuclide transport around an underground repository. The coupled

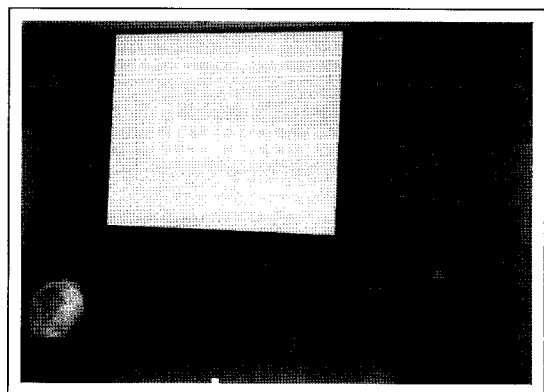
thermal, hydraulic and mechanical numerical models have been developed since the early 1980s. The international cooperative project DECOVALEX, have been studied for the development of numerical simulation of THM process in nuclear waste disposal site. Many numerical codes had been developed, but they usually ignored the propagation of the existing fractures and the initiation of new fractures, both of which are quite important to influence the thermal and hydraulic processes. So, a damage mechanics-based THM model was developed for study the coupled THM process during rock failure. In this damage-based model, conservation equations for energy, mass and momentum are derived for a saturated porous elastic medium. The mathematical formulation of the balance equations and related constitutive relations will not give details here. The simulation result of this model was compared with the experiment results. And it shows that the model could effectively capture the damage process of the heterogeneous rock. Then, the model was used for simulation of a near-field domain, in order to illustrate its capability in studying the evolution of EDZ under THM conditions. Two models namely homogenous model and heterogeneous model were made to discuss the effect of heterogeneity of rock mass. Finally, the simulation results were compared with elastoplastic cellular automata code. It shows that distributions of damaged zone are similar at large. The differences thought to be related to the different constitutive relations being used. When incorporate the effect of tem-

perature and fluid pressure on damage, the damaged zone extended further, because of tensile damage around the opening. The distribution of damage zone around fractured rock mass is captured base on this damage mechanics-based model. The evolution of EDZ under TM coupled condition is found to be significant. Due to the complexity of the rock mass under coupled condition, each parameter should be studied in the future.

Another presentation which received much interest was from Dr. Ming Lei, who is studying in University of Tokyo. The title of his paper is "An optical testing apparatus for rock in triaxial compression and its application". Understanding deformation and failure behavior of rock in triaxial compression is important to construct and maintain underground structures. Generally, the triaxial compression test is hard to observe both of the deformation of rock specimen and flow of pore water. Strain gauge and extensometer are widely used for measuring lateral deformation, but there are some shortcomings in these two methods. A new transparent vessel was developed to solve this problem. Based on this new apparatus, deformation and failure process of rock specimen can be clearly observed with recorded photographs. And some modifications have been made for getting the outflow and inflow of pore water from rock specimen under confining pressure. After brief introduction about the testing apparatus, two types of rock specimen (saturated Tage tuff and Horonobe mudstone) were used in lab test. The test results indicate that rates of outflow and inflow of pore water were



Address in Closing Ceremony, Prof. John Hudson, President of ISRM



Address in Closing Ceremony, Prof. Yunmei Lin, Chairperson of the Organizing Committee

quite different between the two types of rock. The flow rate of pore water was closely related to permeability, porosity and deformability of rock. The reason for the difference of outflow rate and inflow rate in Horonobe rock is thought to be the irrecoverable deformation of the microstructure. Anyway, using this new apparatus, flow behaviors can be observed easily, volume of squeezed pore water can be measured from the photographs which took by digital camera. In the future, creep test will be carried out in this apparatus too. The deformation behaviors and

flow rate will be measured simultaneously, and then the mechanisms of crack propagation, time behavior and flow of pore water will be investigated.

Acknowledgement

Firstly, I would like to express gratitude to my supervisor, Prof. Seokwon Jeon, for his guidance and give me this valuable chance to participate the NDRM 2009 Conference. Also, the financial support during this conference from BK21 is greatly acknowledged.