Special Guest Lecture by:

Dr. John Napier
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Date: Friday June 16, 2006
Time: 11:00 am to 12:00 pm
Location: Mason Building, Room 298

TOPIC

"Computational Simulation of Fracture Processes in Rock Using a Displacement Discontinuity Boundary Element Approach"

ABSTRACT

The understanding of rock failure mechanisms is important in both mining and general geotechnical design applications. In brittle rock formations it is important to capture the essential formation of shear band structures (such as rock burst features) and possible mobilization of existing weakness planes such as faults or natural joint structures near underground excavations. The talk describes experience that has been gained in applying the displacement discontinuity boundary element method to simulate mining-induced fracturing and shear band structures using random assemblies of discontinuity segments. Plane strain conditions are assumed. Fracture growth is simulated by the sequential selection of segments from the random assembly of pre-defined segment positions. It is shown that the random mesh junction coordination properties (i.e. the number of branches available for activation at each junction) can play a strong role in determining the macroscopic behaviour of the fractured region. In particular, if the intrinsic junction coordination of the mesh is altered, it is found that the equivalent "macro" dilation angle is changed. A dimensionless parameter group is suggested as a measure of the intrinsic mesh coordination number. Some further experience is also reported on attempts to extend the displacement discontinuity random mesh approach to three-dimensional failure simulations. Preliminary results suggest that this is much less satisfactory than the simple two-dimensional section simulations and exposes the general lack of understanding of so-called Mode III failure growth mechanisms. Some suggested areas for future research will be presented.

JOHN NAPIER – BIOGRAPHICAL SKETCH

Prof. John Napier is a world renown scientist in the area of computational rock mechanics. He trained originally as a Chemical Engineer at the University of the Witwatersrand and joined the Chamber of Mines Research Organization (COMRO) in 1971. Following his PhD work in the field of Gold Mine Planning, he became involved in rock engineering research and was responsible for the design and development of a computer code for the analysis of large scale tabular mining excavations (MINSIM-D) used extensively in the South African gold mining industry. John subsequently assumed responsibility for coordinating research into deep level gold mine rock mass behavior at COMRO, working mainly to develop models of rock fracture propagation and elastodynamic fault slip behavior. Following the takeover of COMRO by the Council for Scientific and Industrial Research (CSIR), John was elected as a CSIR Fellow in 1997. Since April 2004, John holds an honorary Professorship in the School of Computational and Applied Mathematics at the University of the Witwatersrand, Johannesburg as well as remaining a CSIR Fellow. John is a Fellow of the South African Institute of Mining and Metallurgy and a Fellow of the South African National Institute of Rock Engineering.