CEE AT ILLINOIS
Department of Civil and Environmental Engineering

GEO

CEE 595 – Geotechnical Engineering Seminar

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Process Zone and Size Effect in Rock Fracture

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Abstract

Localized zone of microcracking, referred to as the process zone, is observed in fracture initiation of quasi-brittle materials such as rock and concrete. To investigate the development of the process zone, specimens of different sizes were fabricated from two granites, one small grained and one large grained. Acoustic emission monitoring was used to obtain the locations of micro-cracks at fracture initiation. The results show that both the length and width of the process zone increase with the increase of specimen size. The suitability of a theoretical relationship between the width and length of the process zone and specimen size was investigated experimentally and numerically. Using this relationship, the specimen size in which the width and length of the process zone can be considered as a material property (*i.e.* size independent) was studied. The distinct element method with tension softening contact bond model was used to investigate the development of the intrinsic process zone with the specimen size. A synthetic rock composed of rigid circular particles that interact through normal and shear springs was used in the numerical simulation. The model was calibrated for the uniaxial compressive strength, elastic properties, bending tensile strength, as well as the length and width of the process zone. The numerical results were in agreement with those obtained in the physical experiments.

Speaker's Bio

Ali Tarokh received his undergraduate degree in mining engineering at the University of Tehran, Iran, in 2009. He obtained his MSc in mineral engineering from New Mexico Tech in 2012 where he researched particle modeling of rock fracture, which was followed by work as a tunnel engineer at AECOM, New York. Dr. Tarokh completed his PhD in civil engineering at the University of Minnesota-Twin Cities in 2016. His research was concentrated on laboratory characterization of fluid-saturated rocks within the framework of Biot's theory of poroelasticity. Along with that, he has developed expertise in surface spalling and hydraulic fracturing testing, fracture and size effect, as well as true triaxial testing of rock. Since March 2017, Dr. Tarokh is a postdoctoral researcher in the Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign. As a member of Illinois-based Center for Geologic Storage of CO_2, he is working on laboratory assessment of high-pressure carbon dioxide interaction with the host and caprock.