Time Dependence and Width Constriction in Rock Fracture - Experimental Evidence and Modeling Responses

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The starting point of rock fracture modeling is often Linear Elastic Fracture Mechanics (LEFM). In this regard, and to the extent these models are successful for their intended purposes, LEFM has an extensive history of impact on the field of rock mechanics. However, another important, but perhaps less acclaimed role of LEFM in rock mechanics has not to do with pragmatic success. Rather, LEFM-based models provide a baseline that calls into sharp relief the ways in which rock fracture fails to conform to this classical theory. Examples are provided from laboratory and field experiments wherein LEFM is unable to capture: 1) time-dependence of rock fracturing, or 2) unexpectedly small apparent compliance of rock fractures. Enhancement of rock fracture modeling with kinetic fracture and subcritical fracture theories as well as inclusion of intact bridges leading to constriction of crack aperture in rocks comprise modeling responses that bring the modeling in line with evidence and open the ability to capture time-dependence and width constriction in rock fracturing processes.

BIO

Andrew Bunger is a Professor in the University of Pittsburgh's Department of Civil and Environmental Engineering. He joined the University of Pittsburgh in 2013 after spending 10 years in Melbourne, Australia working in the Geomechanics Group within the Commonwealth Scientific and Industrial Research Organisation (CSIRO). Prior to that, he received his PhD in Geological Engineering from the University of Minnesota. His research interests include the mechanics of hydraulic fractures, coupled fluid-shale interaction, emplacement dynamics of magma-driven dykes and sills, and development of novel materials for wellbore cementing and plugging.