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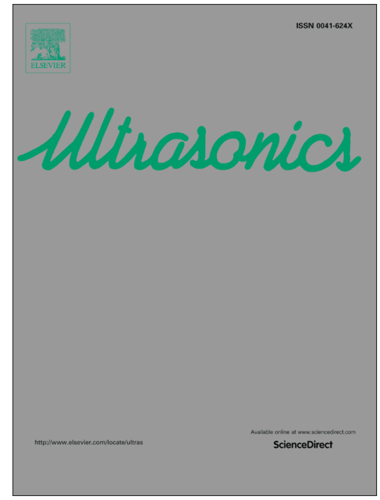

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The length of pre-existing fissures effects on the mechanical properties of cracked red sandstone and strength design in engineering

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Abstract: It is important to study the mechanical properties of cracked rock to understand the engineering behavior of cracked rock mass. Consequently, the influence of the length of pre-existing fissures on the strength, deformation, acoustic emission (AE) and failure characteristics of cracked rock specimen was analyzed, and the optimal selection of strength parameter in engineering design was discussed. The results show that the strength parameters (stress of dilatancy onset and uniaxial compressive strength) and deformation parameters (axial strain and circumferential strain at dilatancy onset and peak point) of cracked rock specimen decrease with the increase of the number of pre-existing fissures, and the relations which can use the negative exponential function to fit. Compared with the intact rock specimens, the different degrees of stress drop phenomena were produced in the process of cracked rock specimens when the stress exceeds the dilatancy onset. At this moment, the cracked rock specimens with the existence of stress drop are not instantaneous failure, but the circumferential strain, volumetric strain and AE signals increase burstingly. And the yield platform was presented in the cracked rock specimen with the length of pre-existing fissure more than 23 mm, the yield failure was gradually conducted around the inner tip of pre-existing fissure, the development of original fissures and new cracks was evolved fully in rock. However, the time of dilatancy onset is always ahead of the the time of that point with the existence of stress drop. It indicates that the stress of dilatancy onset can be as the parameter of strength design in rock engineering, which can effectively prevent the large deformation of rock.

Key words: rock mechanics; pre-existing fissures; red sandstone; strength; deformation; dilatancy behavior

List of Symbols

a Length of pre-existing fissure

c Peak point

cc Initial point of elastic deformation

cd Dilatancy onset

ci Terminal point of elastic deformation

D Region between cd and failure

E_s Elastic modulus