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COMPLETE STRESS-STRAIN BEHAVIOR FOR SHEAR FAILURE OF ROCKS

Zhou Guolin
(Depantment of Civil Engineering, The University of Hong Kong, Hong Kong, China)

博士学位论文摘要 The investigation of complete stress-strain behavior and compressive failure behavior of some Hong Kong rocks are carried out. A large number of tests have been conducted to study the deformation and failure features of rocks. Some interesting test results have been obtained. These results show that localized deformation and failure strongly affect the deformation and failure process of the specimens just prior to the peak stress and in the post-peak stage.

The two types of failure modes, namely exfoliation and shear failure have been investigated in detail. For the exfoliation failure mode, an experiment method has been proposed to observe the exfoliating process. A proposed model has been used to explain the influence of exfoliation on the gross stress-strain curve. It is found that the exfoliation during loading may be one of the reasons that a granite specimen exhibits Class Ⅱ behavior. The influences of machine stiffness control modes, end constraints, loading rate and confining pressure on the test results have been discussed and investigated. A new classification method of rock failure has been proposed.

Special attention has been devoted to the investigation of the localized deformation and failure process of intact rock in the shear failure mode. A test method is proposed to detect the process. It is found that the deformation of rock material may be divided into three stages: namely uniform stage, pre-peak bifurcation stage and post-peak bifurcation stage. This phenomenon has been explained by a proposed qualitative analysis.

It is further found that this localized process will significantly influence the shape of stress-strain curves, that is, the localized deformation is one of reasons that rock displays the effect of length to diameter ratio. A constitutive model is proposed to simulate the localized deformation and failure process. It can simulate the strain softening, strain localization, effect of length to diameter (L/D) ratio, unloading-reloading respons, and elastic modulus degradation, etc. Based on the model, a new strength criterion expressed by the relative shear displacement is proposed. This criterion captures the complex features of peak strength of rock such as the size effect.

Key words rock test, shear failure, localized deformation, peak stress, gross stress-strain curve, strength criterion

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作者 周国林 简介: 男, 38岁, 2000年2月在香港大学土木工程系获博士学位, 导师是李启光、谭国焕和徐 钺博士; 现任黄泽恩顾问师公司高级工程师, 主要从事岩土工程方面的设计咨询工作。