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具有非线性强度包络线的双剪双参数统一强度准则改进式及其特征分析

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摘要　通过应力莫尔圆分析证明现有的双剪双参数统一强度准则采用的强度包络线为线性包络线，在此基础上对原有准则作了改进，改进后的双剪双参数统一强度准则采用了抛物线和双曲线形强度包络线，能够更好地表征岩石的强度特性，特别是抗拉强度特性。对改进式所作的p平面极限线和子午线分析表明，采用抛物线和双曲线形强度包络线基本上不会改变原准则在p平面上的极限线形状，但子午线由直线改为曲线，极限面在主应力空间内分别为抛物面和双曲面，其锥顶距坐标原点也比采用线性强度包络线的要小。从锥形极限面的大小来看，具有双曲线形和抛物线形强度包络线的双剪双参数统一强度准则改进式要小于直线形的，且抛物线形的最小。

关键词　岩石力学；双剪双参数统一强度准则；抛物线和双曲线形强度包络线；p平面极限线；子午线

分类号

IMPROVED EXPRESSIONS OF TWO-PARAMETER DOUBLE SHEAR UNIFIED FAILURE CRITERION WITH NONLINEAR FAILURE ENVELOPES AND THEIR BEHAVIOR ANALYSIS

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Abstract

Analysis of the Mohr circles proves that the original two-parameter double shear unified failure criterion has the linear type failure envelope，and the improved failure criteria with parabolic and hyperbolic type failure envelopes are given out in order to describe the rock failure properties，especially the rock tensile property better than the original one. Analyses of loci in the p plane

and meridian lines show that the parabolic and hyperbolic type failure envelopes have no influences on the shape of the loci in the p plane，but the shape of the meridian lines are changed from straight lines to curved lines. The limit surfaces of the improved criteria are paraboloid or hyperboloid in the principal stress coordinates. Distances from the conic points to the original coordinate point are smaller than those using the linear type failure envelope. Cone sizes among the criteria using three different envelopes are the criteria with parabolic type failure envelope being the smallest，with hyperbolic type failure envelope being the second，and with linear type failure envelope being the largest.

Key words rock mechanics；two-parameter double shear unified failure criterion；parabolic and hyperbolic type failure envelopes；loci in the p plane；meridian line

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