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基于统一强度理论的软岩损伤统计本构模型研究

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摘要 基于统一强度理论, 在考虑洛德参数的基础上, 得到随洛德参数和中间主应力系数变化的材料统一强度参数, 建立可以考虑中间主应力的统一强度理论平面形式的强度准则。假定软岩微元强度分布统计概率, 定义软岩的统计损伤变量, 依据统一强度理论建立三轴应力状态下软岩的损伤统计本构模型。通过软岩的常规三轴试验结果对其进行验证, 对偏应力-应变的理论结果与试验结果进行比较。研究表明, 该本构模型能够较好地反映软岩的偏应力-应变关系, 尤其是应变软化特性。而且依据统一强度理论和统一强度内摩擦角的发挥, 进一步分析表明洛德参数以及中间主应力系数b对偏应力-应变关系有影响, 软岩的偏应力-应变曲线先随洛德参数的增大而上升到一定值, 而后随洛德参数的增大而降低; 随中间主应力系数b的增大而不断增加。

关键词 [岩石力学](#) [统一强度理论](#) [洛德参数](#) [统计损伤变量](#) [本构模型](#)

分类号

STUDY ON STATISTICAL DAMAGE CONSTITUTIVE MODEL OF SOFT ROCK BASED ON UNIFIED STRENGTH THEORY

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Abstract

Based on unified strength theory, considering Lode parameter, unified strength parameters of materials are proposed, which change with Lode parameter and the intermediate principal stress coefficient b, and planar style strength criterion of unified strength theory which can consider the intermediate principal stress is obtained. Assuming distribution statistical probability of micro-units strength, statistical damage variable is defined; and the statistical damage constitutive equation is proposed under triaxial stress state based on the unified strength theory. The proposed constitutive equation is verified by triaxial experiment of soft rock, the comparison between experimental results and theoretical results is processed; and the results show that the proposed constitutive model can predicted the relationship between stress and strain of soft rock, especially the characteristic of strain softening. Furthermore, on the basis of the unified strength theory and the mobilized internal frictional angle of the unified strength parameter, effects of Lode parameter and the intermediate principal stress coefficient b on deviatoric stress-strain relationship are investigated theoretically; and results show that the deviatoric stress-strain curves rise to a certain value with increasing Lode parameter, and then decrease with Lode parameter; and the deviatoric stress-strain curves rise with increasing intermediate principal stress coefficient b.

Key words [rock mechanics](#) [unified strength theory](#) [Lode parameter](#) [statistical damage variable](#) [constitutive model](#)

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