岩石力学与工程学报 2005 24 (05): 761 ISSN: 1000-6915 CN: 42-1397/O3

巷道/隧道围岩非线性流变数学力学模型及其初步应用

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收稿日期 2003-10-27 修回日期 2003-12-22 网络版发布日期 2007-2-7 接受日期 2003-10-27

摘要 研制了三轴巷道/隧道围岩流变试验台，并进行了多年的试验观测。从岩石长期强度的衰减特征和岩石的应变能守恒原则出发，建立了非弹塑粘性元件组合模型的岩石非线性流变数学力学模型，在此基础上建立了巷道/隧道围岩非线性流变数学力学模型。应用线性莫尔强度理论将单轴应力极限转换为三轴应力极限，从而由所测的单轴全应力－应变曲线参数来求围岩三轴应变。依据该模型计算的巷道围岩流变值与试验值拟合较好，该模型在预测巷道破坏圈方面得到初步的成功应用。

关键词 采矿工程；流变；非线性；数学力学模型；巷道；隧道；应用

分类号

NONLINEAR RHEOLOGICAL MATHEMATICAL-MECHANICAL MODEL OF SURROUNDING ROCK DEFORMATION OF ROADWAYS OR TUNNELS AND ITS PRELIMINARY APPLICATION

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Abstract

A set of 3D rheological testing apparatus for surrounding rock of roadways or tunnels was developed by the authors，and rheological experiments and monitoring on it have been going on for over 10 years. Based on attenuation characteristics of long-term strength and strain energy conservation law of rock，a nonlinear rheological mathematical-mechanical model of rock is established，which differs form composite models of elastic，plastic or viscous elements. Based on this model，a nonlinear rheological mathematical-mechanical model of surrounding rock deformation of roadways or tunnels is established. Uniaxial compression strength can be converted to triaxial compression strength by linear Mohr strength theory，so uniaxial compression strength can be used to calculate 3D strain of surrounding rock of roadways or tunnels. The rheological values of surrounding rock deformation of roadways or tunnels calculated with the model are in good coincidence with the values obtained by experiments. The model is successfully applied to forecasting the width of loosened zone of a roadway.

Key words mining engineering；rheology；nonlinear；mathematical-mechanical model；roadway；tunnel；application

DOI:

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