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节理岩石剪切流变特性试验与模型研究

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摘要 利用岩石剪切流变仪，对龙滩水电站大型地下洞室群围岩中的无充填节理岩石进行了剪切流变试验，得到了节理岩石长期抗剪强度参数，与快速剪切试验获得的短期抗剪强度参数进行比较，发现长期抗剪强度参数有所降低，且粘聚力对时间敏感性高于内摩擦角。基于得到的剪切流变试验曲线，采用五元件粘弹性剪切流变模型对表现为粘弹性流变特性的试验曲线进行了辨识，获得了节理岩石的粘弹性剪切流变参数。然后将提出的非线性粘塑性体与五元件粘弹性剪切流变模型串联起来，建立了岩石七元件非线性粘弹塑性剪切流变模型。采用节理岩石加速剪切流变全程曲线，对七元件非线性粘弹塑性剪切流变模型进行了辨识，得到了非线性剪切流变模型材料参数，剪切流变模型与试验结果的比较，显示出了所建剪切流变模型的正确性与合理性。

关键词 岩石力学；节理岩石；剪切流变；非线性粘塑性体；流变指数；非线性粘弹塑性剪切流变模型

分类号

EXPERIMENT AND MODELING INVESTIGATION ON SHEAR RHEOLOGICAL PROPERTY OF JOINT ROCK

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Abstract

The shear rheology experiment on the shear rheology equipment is carried out for unfilled jointed rock specimens in the surrounding rock mass of a huge underground cave in Longtan hydropower station. The long-term shear strength parameters of jointed rock are gained. Compared with the short-term shear strength parameters gotten by rapid shear experiment，the long-term shear strength parameters have some reduction. What's more，the sensitivity of cohesion on time is

higher than that of internal friction angle. Based on the shear rheological curves of joint rock obtained on rock shear rheology equipment，five-component viscoelastic shear rheology model is used to identify the curves that show the viscoelastic rheological properties，and the viscoelastic shear rheological parameters of jointed rock are obtained. Then by connecting nonlinear viscoplastic body(NVPB) put forward by the author and five-component viscoelastic shear rheology model in series，a seven-component nonlinear visco-elastoplastic shear rheology model of rock is constructed. Then by using complete accelerative shear rheological curve of joint rock，the identification of the proposed seven-component nonlinear visco-elastoplastic shear rheology model of rock is carried out. The correlative parameters of nonlinear shear rheology model such as viscoelastic shear modulus and viscosity，etc.. are also gained. The comparison between the shear rheology model and experimental result shows that the proposed non-linear shear rheology model is right and reasonable.

Key words rock mechanics；jointed rock；shear rheology；nonlinear viscoplastic body(NVPB)；rheological index；nonlinear visco-elastoplastic shear rheology model

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