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论文

节理剪胀耦合的岩体渗透特性数值研究与经验公式

赵延林，王卫军，万文，赵伏军，王敏

1.湖南科技大学 煤矿安全开采技术湖南省重点实验室，湖南 湘潭 411201；
2.湖南科技大学 能源与安全工程学院，湖南 湘潭 411201

摘要：

利用UDEC软件，建立岩石节理剪胀导致岩体渗透特性改变的离散元数值模型，探讨节理剪胀效应对岩体等效渗透系数的影响。数值研究表明，在节理法向闭合和节理剪胀两种机制的共同作用下，随偏应力系数的增加，岩体等效渗透系数遵循先减小后增加的变化规律。当偏应力系数较小时，节理法向闭合机制占主导因素，导致等效渗透系数随偏应力系数的增大而减小；当偏应力系数较大时，节理剪胀机制占主导因素，导致等效渗透系数呈数量级增加。在岩体等效渗透系数的流固耦合方程中必须体现节理剪胀因素。提出的裂隙岩体等效渗透系数经验公式考虑了节理法向闭合和节理剪胀对等效渗透系数的贡献，且物理意义明确；最后参考J.ZHANG的实验研究成果验证了经验公式的合理性。

关键词： 节理剪胀；渗透特性；等效渗透系数；偏应力系数；经验公式

Numerical study of joint shear dilatation coupling seepage characteristic of rock mass and experiential formula

Abstract:

A discrete element numerical model that rock joint shear dilatation leads to change of rock mass conductivity was established by using UDEC Software，and the effect of rock joint dilatancy on rock mass equivalent permeability coefficient was investigated.As the numerical investigation is shown，with the increase of deviatoric stress coefficient，the variation of rock mass equivalent permeability coefficient is reduced at first and then increased under the interaction of joint normal closure and joint shear dilatation.When deviatoric stress coefficient is smaller，the mechanism of normal stress closure is the main factor，which，with the increase of deviatoric stress coefficient，leads to the decrease of equivalent permeability coefficient.While deviatoric stress coefficient is larger，joint shear dilatation mechanism is the leading factor，which leads to equivalent permeability coefficient increasing in the magnitude order.The fluid-solid coupling equation for rock mass equivalent permeability coefficient must reflect the factor of joint shear dilatation.The empirical formula for rock mass equivalent permeability coefficient considered the contribution of joint normal stress closure and joint shear dilatation to equivalent permeability coefficient was proposed，moreover，it is of definite physical meaning.Through J.Zhang’s experimental study results verified the feasibility of empirical formula.

Keywords: joint shear dilatation；seepage characteristic；equivalent permeability coefficient；deviatoric stress coefficient；empirical formula

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通讯作者: 赵延林

作者简介: 赵延林(1973—)，男，湖南湘潭人，副教授，博士

作者Email: yanlin_8@tom.com

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