

## 岩盤隧道周圍水力-力學耦合特性對流場之影響

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### 摘要

在隧道工程與放射性廢棄物處置的議題中，地下水於隧道壁面周圍之流動行為與流量常為工程中決定成敗的關鍵。前人的研究發現不連續面位態的分布及應力的異向性會使裂隙岩體的水力傳導係數產生異向性，同時也發現裂隙力學行為中之剪脹對於隧道周圍流場的分布是不可忽略之要素，但其在整體計算中並未考慮孔隙水壓的影響。然而在相關工程議題中，地下深處之孔隙水壓對應力的影響是顯著的，故本研究著重於探討孔隙水壓對隧道流場的影響。本研究將裂隙岩體考慮為擬連續體，計算其受邊界應力影響下的水力傳導係數，再以有限差分法得到隧道周圍的流場分布，並在考慮孔隙水壓的情況下，計算水力與力學行為間的互制作用。結果顯示考慮孔隙水壓後隧道壁面上之入流量相較於未考慮孔隙水壓時的結果有明顯的增加，當模型建立於地下約 650 公尺深處，且裂隙及應力皆為均向時，考慮孔隙水壓將使隧道壁面上之流量增加約莫 50%，故孔隙水壓為不可忽略的因素。

## **Influence of hydraulic-mechanical coupling characteristics around the rock tunnel on the flow field**

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### **Abstract**

In the issue of tunnel engineering and disposal of radioactive waste, the groundwater flow around the tunnel wall is very critical. Previous study have found that the anisotropy of discontinuities and the anisotropy of stress will cause anisotropy in the hydraulic conductivity of fractured rock, and also found that the dilatancy in the mechanical behavior of fracture is a non-negligible factor for the distribution of the flow field around the tunnel. But it didn't consider the influence of pore water pressure in the overall calculation. However in the related engineering issues, the effect of pore water pressure on the stress in the depth of the underground is significant, so this study focuses on the influence of pore water pressure to the tunnel flow field. This study considers fractured rock mass as a quasi-continuum mass, and the hydraulic conductivity coefficient under the influence of the boundary stress is calculated. Then the flow field distribution around the tunnel is obtained by the finite difference method, and the interaction between the hydraulic behavior and mechanical behavior is calculated in the case of considering the pore water pressure. The results show that the inflow rate on the tunnel wall after considering the pore water pressure is significantly higher than that when the pore water pressure is not considered. When the model is built about 650 meters deep underground and the fractures and stresses are isotropic, considering the pore water pressure will increase the flow rate on the tunnel wall about 50%. Therefore, pore water pressure is a non-negligible factor.