

论文

超千米深部全断面岩石掘进机卡机机理

刘泉声, 黄兴, 时凯, 刘学伟

- 1. 中国科学院武汉岩土力学研究所 岩土力学与工程国家重点实验室, 湖北 武汉 430071;
- 2. 武汉大学 土木建筑工程学院, 湖北 武汉 430072

摘要:

为了解决超千米深井巷道建设面临的严峻挑战, 拟将全断面岩石隧道掘进机 (TBM) 在解决关键岩石力学问题和机械制造问题的基础上加以改进引入到超千米深井巷道建设。然而深部高应力挤压变形将导致TBM的护盾极易被卡塞。揭示了TBM的卡机机理: 当护盾周围围岩变形量超过开挖预留的变形量, 围岩开始与护盾接触并挤压护盾, 进而在TBM推进时围岩对护盾产生摩擦阻力, 当TBM推力无法克服围岩对护盾产生的摩擦阻力时, 便导致TBM护盾被卡。提出了相应的卡机状态判据。提出了判断护盾被卡状态的理论计算方法及过程: 考虑工作面空间效应, 基于Hoek-Brown准则研究了护盾周围围岩收敛变形沿巷道轴向的变化规律, 计算出作用在护盾上的围岩压力, 进而计算围岩对护盾的摩擦阻力, 最后根据卡机状态判据判断护盾是否被卡。

关键词: 超千米深部; TBM; 卡机; 机理

Jamming mechanism of full face tunnel boring machine in over thousand-meter depths

Abstract:

In order to overcome the challenge of deep roadway constructions of over a kilometer deep, through the analysis of the advantages and the working conditions of TBM, it is believed that TBM has can be introduced to the deep roadway construction. Therefore, the intention is to introduce TBM to the roadway construction of over a kilometer deep, after it is be improved on the basis of solving the key rock mechanics and machinery manufacturing problems involved. Deep and high stress squeezing deformation can cause the TBM shield to be easily jammed. This paper determines the TBM jamming mechanism as: when the shield surrounding rock convergence exceeds the over-excavation amount, the surrounding rock begins to contact and squeeze the shield, which then produces friction when the TBM shield advanced. If the thrust force cannot overcome the frictional resistance, TBM will be jammed. This paper also puts forward the corresponding jamming state criterion and the theoretical calculation method and process: considering the working face effect, based on the Hoek-Brown failure criterion, the convergent deformation of surrounding rock along the axial variation around the shield should be investigated, the pressure of the surrounding rock on the shield, and the frictional resistance of the surrounding rock to shield should be calculated, and finally, the shield jamming state can be assessed by the criterion.

Keywords: over thousand-meter depths; TBM; shield jamming; mechanism

收稿日期 2011-12-23 修回日期 2012-04-06 网络版发布日期 2013-02-21

DOI:

基金项目:

国家自然科学基金资助项目 (41130742); 中国科学院知识创新工程重要方向资助项目 (kzcx2-yw-152)

通讯作者: 刘泉声

作者简介: 刘泉声(1962—), 男, 江苏溧阳人, 研究员, 博士生导师

作者Email: liuqs@whrsm.ac.cn

参考文献:

扩展功能

本文信息

- Supporting info
- PDF(1149KB)
- [HTML全文]
- 参考文献PDF
- 参考文献

服务与反馈

- 把本文推荐给朋友
- 加入我的书架
- 加入引用管理器
- 引用本文
- Email Alert
- 文章反馈
- 浏览反馈信息

本文关键词相关文章

- 超千米深部; TBM; 卡机; 机理

本文作者相关文章

- 刘泉声
- 时凯
- 黄兴

PubMed

- Article by Liu,Q.Q
- Article by Shi,k
- Article by Huang,x

