

# 基于ABAQUS平台的四渡河悬索桥 隧道锚围岩稳定性分析

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**摘要** 隧道锚在实际工程中应用不多, 目前对其稳定性的研究相对较少。基于大型通用非  
线性有限元分析软件ABAQUS的计算平台, 利用该软件提供的用户材料子程序UMAT接口, 将  
基于Rankine准则的Mohr-Coulomb模型添入ABAQUS中, 采用Fortran语言开发了接口程序,  
并在此基础上对四渡河悬索桥隧道锚进行三维弹塑性有限元分析, 计算了初始地应力场,  
模拟了隧道锚与公路隧道的新奥法施工过程, 并考虑了开挖过程中隧洞周边接触软弱层的  
形成。将锚碇围岩的稳定性和锚固系统的整体安全度作为主要研究内容, 其计算结果和长  
江科学院采用FLAC3D的分析结果比较, 二者具有一致性。研究结果表明, 所研制的接口程  
序开发思路正确, 计算精度满足要求, 所完成的工作为隧道锚设计提供了依据, 具有相当  
重要的工程价值。

**关键词** [隧道工程](#); [有限元](#); [UMAT子程序](#); [Rankine准则](#); [Mohr-Coulomb模型](#); [隧道  
锚](#); [弹塑性分析](#); [稳定性](#)

分类号

## STABILITY ANALYSIS OF ROCK AROUND TUNNEL- TYPE ANCHORAGE OF SIDUHE SUSPENSION BRIDGE BASED ON ABAQUS SOFTWARE

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### Abstract

Tunnel-type anchorage is not widely used in practice, and not enough attentions have been paid  
to its stability up to now. Based on the user-defined material subroutine interface provided by  
ABAQUS, a new model by combining Rankine and Mohr-Coulomb criteria is established, and  
corresponding interface program is developed, in which Fortran language is adopted. Based on this  
model, a three-dimensional elasto plastic finite element analysis on the tunnel-type anchorage of  
Siduhe suspension bridge is performed. The initial geostress field is calculated, and the  
construction process of the tunnel-type anchorage and road tunnel with New Austrian tunneling  
method is simulated. At the same time, the weak terrane around the tunnel-type anchorage  
appeared in the excavation is considered. The stability and safety factor of the rock around the  
tunnel-type anchorage are main contents. The results conform to those from FLAC3D analysis  
provided by Yangtze River Scientific Research Institute, which shows the feasibility and validity  
of the interface subroutine. The results can provide a reference to the current design rule of tunnel-  
type anchorage.

Key words: tunneling engineering; finite element; UMAT subroutine; Rankine  
criterion; Mohr-Coulomb model; tunnel-type anchorage; elastoplastic analysis; stability

**Key words** [tunneling engineering](#); [finite element](#); [UMAT subroutine](#); [Rankine  
criterion](#); [Mohr-Coulomb model](#); [tunnel-type anchorage](#); [elastoplastic](#)

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