

## 开挖损伤区近场模型THM耦合过程的BMT模拟

潘鹏志, 冯夏庭, 周辉

(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)

收稿日期 2007-3-8 修回日期 2007-8-27 网络版发布日期 2008-1-2 接受日期 2007-3-8

摘要 以正在进行的大型国际合作项目DECOVALEX-THMC为背景, 利用自行开发的弹塑性细胞自动机模拟系统, 对开挖损伤区近场模型域进行程序校验(BMT)模拟研究, 揭示高放废物从处置开始直至 $1 \times 10^6$  a的演化过程中, 裂隙的存在对开挖损伤区力学性能的影响。首先进行的是弹性分析, 研究对象包括开挖损伤区近场均质模型和包含复杂裂隙网络的非均质模型域, 该裂隙网络是瑞典Äspö硬岩实验室根据裂隙映射得出的真实裂隙网络分布。引入简单的弱化参数表达式, 用弱化元胞单元来代表模型中的复杂裂隙网络, 以模拟裂隙的软化效应。采用项目指导委员会提供的随时间变化的温度、应力、水流边界条件, 模拟地质围岩从开挖、核废物处置、加热 $100 \sim 1 \times 10^6$  a的力学演化过程。模拟结果显示, 裂隙的存在对应力场、变形场和破坏过程有较大的影响, 并将模拟的结果与国际上其他研究小组的模拟结果进行对比, 吻合较好, 说明该模型和方法的合理性, 并可适合于该项目下一步的研究工作。在此基础上, 采用弹塑性细胞自动机模拟系统, 对裂隙网络模型和均质模型进行弹塑性破坏过程分析, 结果表明, 由于裂隙的存在, 裂隙网络模型的破坏过程更加复杂。

关键词 [岩石力学](#); [DECOVALEX-THMC](#); [弹塑性细胞自动机](#); [复杂裂隙网络](#); [开挖损伤区](#); [温度-渗流-应力耦合](#); [破坏过程](#)

分类号

## MT SIMULATION OF COUPLED THM PROCESSES BY NEAR FIELD MODEL IN EXCAVATION DAMAGE ZONE

PAN Pengzhi, FENG Xiating, ZHOU Hui

(State Key Laboratory of Geomechanics and Geotechnical Engineering, Institute of Rock and Soil Mechanics, Chinese Academy of Sciences, Wuhan, Hubei 430071, China)

### Abstract

The results of benchmark test(BMT) from the study on coupled thermo-hydro-mechanical(THM) processes in the excavation damage zone(EDZ) around nuclear waste repository in fractured rocks are presented. This is an important part of international cooperation project DECOVALEX-THMC TASK B. The results focus on the influence of fractures on the evolution of EDZ over  $1 \times 10^6$  years after disposal of high-level radioactive waste. The numerical study is conducted for two model domains, homogeneous and heterogeneous near-field models, surrounding a repository. The heterogeneous near-field model domain includes a realistic fracture network derived by detailed fracture mappings at the Äspö hard rock laboratory, Sweden. In this study, fractures are represented discretely, but softening and weakening effects of fractures intersecting a continuum element are simulated using continuum elements by a reduction in modulus. Using this approach for fracture representation, numerical analyses are conducted using elastoplastic cellular automata(EPCA) code. Elastic and elastoplastic analyses are performed to study the evolution of stress and deformations in EDZ adopting time-dependent thermal, mechanical and fluid pressure boundary conditions. The analysis

### 扩展功能

#### 本文信息

- ▶ [Supporting info](#)
- ▶ [PDF\(675KB\)](#)
- ▶ [\[HTML全文\]\(0KB\)](#)
- ▶ [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](#)
- ▶ [复制索引](#)
- ▶ [Email Alert](#)
- ▶ [文章反馈](#)
- ▶ [浏览反馈信息](#)

#### 相关信息

- ▶ [本刊中 包含](#)  
“[岩石力学](#); [DECOVALEX-THMC](#); [弹塑性细胞自动机](#); [复杂裂隙网络](#); [开挖损伤区](#); [温度-渗流-应力耦合](#); [破坏过程](#)”的
- [相关文章](#)

#### ▶本文作者相关文章

- [潘鹏志](#)
- [冯夏庭](#)
- [周辉](#)

shows a strong impact of fractures on the distribution of rock stress and deformation as well as the failure process. The numerical results are consistent with those obtained by other international research teams, indicating the validity of EPCA code. The results also indicate that the EPCA code can be used to perform next step analysis of DECOVALEX-THMC project.

**Key words** [rock mechanics](#); [DECOVALEX-THMC](#); [elastoplastic cellular automata\(EPCA\)](#); [complex fracture network](#); [excavation damage zone\(EDZ\)](#); [thermo-hydro-mechanical\(THM\) coupling](#); [failure process](#)

DOI:

---

通讯作者