

基于数字图像处理的冻融页岩温度场的数值分析方法

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摘要 利用数字图像处理技术与有限元软件ANSYS相结合的方法对冻融岩石CT图像进行处理, 获得岩石细观结构图像, 分析冻融岩石的温度场分布规律。结果表明, 数字图像处理技术可以准确地描述岩石损伤的空间分布, 最大限度地挖掘利用岩石CT图像所隐含的信息。岩石细观结构图像与有限元法的结合可实现考虑岩石细观介质及其空间分布的冻融温度场的有限元模拟, 岩石的细观结构决定了冻融岩石温度场的分布规律, 其对岩石冻融损伤破坏过程有重要影响。提出的冻融岩石温度场研究方法可从细观尺度探索寒区岩石工程冻害产生的原因, 为解决寒区岩石工程冻胀、融沉问题提供新的方法。

关键词 [岩石力学](#); [冻融岩石](#); [细观](#); [CT图像](#); [数字图像处理](#); [有限元法](#); [温度场](#); [规律](#)

分类号

NUMERICAL ANALYSIS METHOD FOR TEMPERATURE FIELD OF FREEZING-THAWING SHALE BASED ON DIGITAL IMAGE PROCESSING

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Abstract

Combining technique of digital image processing and finite element software ANSYS, the CT image of freezing-thawing shale is processed; and the meso-structure image of shale is obtained. The law of temperature field of freezing-thawing shale is analyzed in negative temperature condition. Study results show that the digital image processing method can be used as a measurement tool to construct a digital representation for actual spatial distribution of different materials in shale. It not only can accurately describe the spatial distribution of shale damage but also can get the maximum use out of hidden information in CT image of shale. The meso-structure image is incorporated into finite element software ANSYS to achieve the goal of simulating temperature field law of freezing-thawing shale with consideration of the actual spatial distribution of meso-medium and initial shale damage. The following conclusion is drawn by analysis. The meso-structure determines the

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distribution of temperature field of freezing-thawing shale and also has an important influence on freezing-thawing damage process. The proposed approach can grope for the hazard reasons in view of meso-scale and provide a new way to research the inherent mechanisms of frost heave, thaw settlement and the consolidation of frozen ground.

Key words [rock mechanics](#); [freezing-thawing rock](#); [meso-scale](#); [CT image](#); [digital image processing](#); [finite element method](#); [temperature field](#); [law](#)

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