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尾砂分形级配与胶结强度的知识库研究

刘志祥，李夕兵

(中南大学 资源与安全工程学院，湖南 长沙 410083)

摘要　　采用分形理论研究了尾砂材料的级配。分析了国内外大量矿山的尾砂材料分形级配与强度试验数据，用神经网络建立了尾砂胶结强度与水泥含量、浓度、孔隙分形维数及分形维数相关率的知识库模型。考虑神经网络在训练大规模样品时易陷入局部极小，用梯度下降法与混沌优化方法相结合，使神经网络实现快速训练的同时，避免陷入局部极小。研究结果表明：尾砂孔隙分形维数减小，尾砂胶结强度增高；分维形数相关率越好，尾砂胶结强度越高。孔隙分形维数和分形维数相关率反映了尾砂粒度分布的整体信息，可用来判断尾砂级配的合理性。应用知识库模型可以根据尾砂的级配特性，预测不同水泥含量、不同浓度下的尾砂胶结充填体强度，指导矿山充填设计。

关键词　　采矿工程；尾砂级配；分形维数；神经网络；知识库
分类号

STUDY ON FRACTAL GRADATION OF TAILINGS AND KNOWLEDGE BANK OF ITS CEMENTING STRENGTH

LIU Zhi-xiang，LI Xi-bing

(College of Resources and Safety Engineering，Central South University，Changsha 410083，China)

Abstract
 Characteristics of tailings gradation are studied by using fractal theory. Experimental data about the fractal gradations of tailings material and their cementing strength from a lot of mines are analyzed. Neural network is used to establish the model of knowledge bank which embodies the relations between strengths of cemented tailings and content of cement，consistence，fractal dimension of porosity and correlation coefficient of fractal dimension. Combining grading method with chaotic optimization，the neural network model achieves rapid training and avoids local minimum when there are a lot of samples to be trained. Research results show that the strengths of cemented tailings increase with the decrease of fractal dimension of porosity and with the increase of the correlation coefficients of fractal dimension. Because fractal dimension of porosity and its correlation coefficient embody the global distribution information of tailing granule，they can be used as a standard of rationality of gradation. According to gradation of tailings，the knowledge bank model can predict the strengths of cemented tailings in different contents of cement or consistence，and guide filling design in mine.

Key words　 mining engineering；tailings gradation；fractal dimension；neural network；knowledge bank

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