

## 孔隙介质三维逾渗机制数值模拟研究

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**摘要** 论述三维孔隙介质的逾渗研究方法, 基于VC++6.0开发三维逾渗模拟软件。利用重正化群原理, 通过数值模拟的方法研究孔隙介质三维逾渗机制和逾渗团特性, 提出有效表面积率概念。研究结果表明: 团的数量随着孔隙率的增加先增加后减小, 在孔隙率为0.20时达到最大值; 随着孔隙率的增加, 最大团表面积在孔隙率大于阈值时开始快速增加, 然后呈减小趋势, 在孔隙率为0.55时达到最大值, 此时的有效表面积率达到0.98; 当孔隙率为逾越阈值0.311 6时, 发现逾渗团的大小是一种统计上的随机分形, 其分形维数 $D = 2.934$ 。

**关键词** [土力学](#); [孔隙](#); [分形](#); [逾渗概率](#); [渗透性](#); [比表面积](#); [重正化群](#)

分类号

## NUMERICAL SIMULATION OF 3D PERCOLATION MECHANISM IN POROUS MEDIA

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### Abstract

The research methods of percolation in 3D porous media are presented. Based on VC++6.0, the software to simulate percolation is developed. The 3D percolation mechanism in porous media, the characteristics of percolation cluster by numerical simulation method, and the theory of renormalization are studied. The effective surface area rate is proposed, and the achieved results indicate: (1) the number of cluster increases with the increasing porosity in the beginning and decreases at a later time when the value of porosity is 0.20, and the number of cluster has the maximum value; (2) with the increasing of porosity, the surface area of the largest cluster increases, and the value fleetness increases as the value of porosity is larger than percolation threshold; and (3) when porosity is 0.55, the surface area of the largest cluster reaches the maximum value, and the value of effective surface area rate is 0.98. When the value of porosity is 0.311 6, the percolation cluster is a random fractal and the fractal dimension can be deemed as  $D = 2.934$ .

**Key words** [soil mechanics](#); [pores](#); [fractal](#); [percolation probability](#); [permeability](#); [specific surface area](#); [renormalization](#)

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