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离散单元法对粒状土的微观特性研究探讨

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NEW DEVELOPMENTS OF MICROSCALE STUDY ON GRANULAR SOIL USING DISCRETE ELEMENT METHOD

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摘要 粒状土的微观结构和微观力学被认为是其宏观力学和体积特性的内在根本因素,近年来得到越来越多的关注和研究。离散单元法作为一种研究颗粒材料的数值模拟计算方法,比试验方法快捷、简便、经济,而且能够容易得到在实验室试验中很难或无法得到的更多重要的微观结构和微观力学的信息,近年来得到越来越多应用。本文介绍了离散单元法对土的微观特性研究的一些最新方法和进展,对数值建模中的一些重要方面如比重(质量)放大、树脂薄膜模拟等方面进行了阐述,对离散单元法在土的微观结构分析(如颗粒旋转、颗粒位移、中尺度孔隙率分布)的一些最新研究作了分析和介绍。分析表明,离散单元法是研究粒状土的微观特性的一个有力工具,可以对土的宏观特性从微观角度得到更好的解释和认识。

关键词: 粒状土 离散单元法 数值建模 微观特性

Abstract: Microstructure and micromechanics of granular soils have been of interest to many researchers because of their significant role in the macroscale response. Discrete element method(DEM) is usually simpler, faster, and cheaper than the traditional experimental method and able to obtain some information that is difficult or inaccessible in the experimental method. In this paper, some new developments of the microscale study on granular soil using DEM are briefly reviewed. Some issues in numerical modeling such as density(mass) scaling and membrane boundary simulation are discussed. The new developments on microstructure study such as particle rotation and displacement and mesoscale void ratio distribution using DEM are analyzed. It is concluded that DEM is a powerful tool that can capture the discrete characteristics of the granular materials.

Key words: Granular soil Discrete element method Numerical modeling Microscale characteristic

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