

扰动状态理论在岩土力学问题中的应用

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摘要 基于扰动状态理论, 提出岩石三轴受压响应和土的应力各向异性响应描述方法。扰动状态理论认为, 材料受荷时的响应是2种参考状态响应的加权平均。处于相对完整状态下的材料响应和处于调节后状态下的材料响应, 是以一个扰动因子作为权函数相加构成材料的真实响应。扰动状态理论的指导思想是平均化, 参考状态本身并不发生劣化过程。在岩石的三轴受压响应描述问题中, 应用理论拟合红砂岩常规三轴受压试验全过程应力-应变关系曲线, 其相应的试验是在RMT-150B岩石力学试验系统下完成。从压密点开始描述应力-应变关系。扰动因子的参数取值与围压相关。在土的应力各向异性响应描述问题中, 利用单屈服面分级模型, 叠加各向异性扰动因子, 使材料响应表现出应力各向异性性质。扰动因子向量的方向与材料单元体应力主方向相同。给出应力各向异性扰动状态理论的有限元实现过程, 包括物理量初始值确定、应力状态判断和强化漂移修正的具体步骤。2个相应算例分别证明该方法的有效性。

关键词 [岩土力学; 扰动状态理论; 软化; 单屈服面分级模型; 各向异性](#)

分类号

APPLICATION OF DISTURBED STATE CONCEPT TO ISSUES IN GEOTECHNICAL ENGINEERING

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Abstract

The triaxial compressive response depiction method of rocks and anisotropy response depiction method of soils are proposed based on the disturbed state concept(DSC). DSC defines the response of material that is subjected to loading is a weighted average value of two reference response states. The actual response is composed of relative intact state response and fully adjusted state response with a disturbance factor as the weighted factor. DSC presents an average course, but the reference state responses are not displayed deteriorating course. On the triaxial compressive response depiction method of rock, DSC gives qualified fitness of stress-strain softening phase of red sandstone under regular triaxial compressive test. Steady entire phase of the stress-strain curve shows the ability of RMT-150B rock experiment instrument. Stress-strain relationship curve is described after the compact point. Disturbance factor parameters change with confining pressure value. On the anisotropy response depiction method of soil, anisotropic disturbance factor is superposed to isotropic results

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obtained from hierarchical single surface(HISS) model utility to show stress anisotropic characteristics of the material. The orientation of disturbance factor vector is the same as that of vector of material unit stress. The finite element method process of stress anisotropic DSC based on HISS model is presented, including detailed steps of loading and unloading certification, initial value confirmation and hardening floating rectification. Two examples prove the effectiveness of the introduced methods.

Key words [rock and soil mechanics](#); [disturbed state concept](#); [softening](#); [hierarchical single surface\(HISS\) model](#); [anisotropy](#)

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