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基于三剪屈服准则的空间轴对称特征线场理论及其应用

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摘 要：基于三剪屈服准则建立了有重材料的空间轴对称特征线场理论，其特点是：在描述空间轴对称三向应力作用下的材料屈服特性时，三剪屈服准则较Mohr-Coulomb屈服准则能反映中间主应力对材料屈服的影响，并且该准则还可用一个表达式来精确表达工程中常用的Mohr-Coulomb屈服准则、Tresca屈服准则和Mises屈服准则，从而提高准则对材料的适用范围；在描述材料塑性区内的应力状态时，摒弃了以往基于Mohr-Coulomb屈服准则必须采用的Haar-Von Karman完全塑性假设，通过引入中间主应力参数来表达不同材料可能具有的不同塑性区应力状态，并且Haar-Von Karman完全塑性假设仅为其特例。另外，利用该特征线场理论研究了竖井井壁压力的计算问题并与传统方法做了比较。结果表明：该方法能更好地反映井周岩土屈服特性及塑性区应力状态对井壁压力的影响。

关键字： 三剪屈服准则；空间轴对称线场理论；井壁压力

Axisymmetric characteristics line theory based on triple shear unified yield criterion and its applications

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Abstract: The axisymmetric characteristics line theory for weight materials was established based on the triple shear unified yield criterion. The main features are as follows: in describing the yield properties for materials under axisymmetric three dimensional stress states, the triple shear unified yield criterion used here can reflect the intermediate principal stress effects on the yield characteristics for materials compared with the Mohr-Coulomb yield criterion used before, and can be suitable to more kinds of materials because the common used criteria such as the Mohr-Coulomb failure criterion, the Tresca yield criterion and the Von Mises yield criterion can be expressed accurately with its only one equation. In describing the stress states in plastic zone, the Haar-Von Karman plasticity hypothesis based on the Mohr-Coulomb yield criterion is neglected through introducing the intermediate principal stress parameter to express the different stress states in plastic zones for

different materials. This method can also take the Haar-Von Karman plasticity hypothesis as one of its special cases. As an example, pressures acting on the shaft wall were researched using the new axisymmetric characteristics line theory and results were compared with the traditional method. The results show that the proposed method gives a better description to the pressures acting on shafts influenced by yield properties for rock and/or soil round the shafts and the stress states in plastic zones.

Key words: triple shear unified yield criterion; unified axisymmetric characteristics line theory; pressure acting on shaft wall

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