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ANALYSIS ON INCLINATION ANGLE OF SHEAR BAND UNDER LOW CONFINING PRESSURE BASED ON GRADIENT-DEPENDENT PLASTICITY

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摘要 The inclination angle of shear band is analyzed considering heterogeneity of rock material when a single shear band is formed in the center of specimen under triaxial compression. The analytical solution of post-peak axial stress-axial strain curve is deduced using the assumption that the total post-peak deformation is composed of entire uniform elastic deformation and localized shear plastic deformation dependent on the thickness of shear band. The obtained solution shows that the post-peak stiffness is related to the inclination angle of shear band，confining pressure，thickness of shear band and elastic modulus，etc. Using the solution，the expression for the inclination angle of shear band can be presented easily and it is dependent on constitutive parameters of rock material and geometry parameters of rock specimen. Larger dilation angle or loading rate leads to increment of the inclination angle. In addition，the inclination angle increases with the thickness of the shear band，which cannot be explained or forecasted by other existing solutions，such as Coulomb inclination，Roscoe inclination and Arthur inclination，etc. The presented analytical results are compared with earlier experimental investigations and the agreement is good.

关键词 gradient-dependent plasticity,localization,inclination angle,shear band,confining pressure

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Abstract

The inclination angle of shear band is analyzed considering heterogeneity of rock material when a single shear band is formed in the center of specimen under triaxial compression. The analytical solution of post-peak axial stress-axial strain curve is deduced using the assumption that the total post-peak deformation is composed of entire uniform elastic deformation and localized shear plastic deformation dependent on the thickness of shear band. The obtained solution shows that the post-peak stiffness is related to the inclination angle of shear band，confining pressure，thickness of shear band and elastic modulus，etc. Using the solution，the expression for the inclination angle of shear band can be presented easily and it is dependent on constitutive parameters of rock material and geometry parameters of rock specimen. Larger dilation angle or loading rate leads to increment of the inclination angle. In addition，the inclination angle increases with the thickness of the shear band，which cannot be explained or forecasted by other existing solutions，such as Coulomb inclination，Roscoe inclination and Arthur inclination，etc. The presented analytical results are compared with earlier experimental investigations and the agreement is good.

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