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**Deformation analysis of shear band in granular materials via a robust plane
shear test and numerical simulation**

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Abstract: Understanding the deformation mechanism of shear band for granular materials can predict granular structure failure and prevent natural disaster in the engineering fields. In this work, based on the Couette flow principle, a plane shear test is proposed to loosen the boundary constraint condition of the sample. The process of deformation and properties of shear band are studied through a series of plane shear tests and numerical simulations. The results show that the deformation process and pattern of shear band can be observed by the proposed plane shear test clearly, and the influences of vertical pressure and shear rate on the properties of shear band are investigated.

Keywords: Granular materials; Shear band; Shear test; Numerical simulation; Experiment

1. Introduction

Granular materials, such as soils, sediments, stones and concrete, are normally produced by the interaction of a large number of solid grains, which have been widely applied in highways, tunnels, foundations, slopes, levees and dams [1-3]. The investigation of local deformation of granular materials, referred to as the shear band, is a matter of great interest to mechanics, materials, industrial, civil and hydraulic

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