Technical Note

A Two-Dimensional Model of En-Echelon Jointed Rock Masses with Multi-Discontinuity Geometry Parameters

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1. Introduction

It is well known that discontinuities (hereafter referred to as joints) can have a major effect on the engineering properties of a rock mass. The modelling of jointed rock masses has been described in the literature, where geometric parameters which characterize joints are described (Baecher and Einstein, 1977; Baecher and Lanney, 1978; Einstein and Baecher, 1983; Priest and Samaniego, 1983). However, it is important to distinguish the geometric characteristics of individual joints from those of the assembly of joints. In fact, a rock mass usually consists of many joints rather than a single one. In addition, the instability, deformability and permeability of a rock mass not only depend upon the geometry and strength of many individual joints but are also related to the geometric position of all joints.

In this technical note, all the geometric characteristics of joints are described using two types of parameters. One type is called “individual joint geometry parameter”, and describes characteristics such as orientation, size, surface geometry and aperture. The other type is called “multi-joint geometry parameter”, and describes characteristics such as spacing as well as offset, persistence and overlap ratio, which will be defined below. In the following sections, the individual joint geometry parameters and the multi-joint geometry parameters are used to model en-echelon jointed rock masses.

2. Definition of Offset $\Omega_s$, Persistence $P_i$ and Overlap Ratio $O_r$ of Joint Traces

It may be seen in-situ that there is always some distance between two adjacent joint traces however close they are to each other. Fig. 1 shows such a single group of parallel joint traces in a sampling window on an
outcrop of a rock mass. The vertical distance between two parallel adjacent traces or their extensions is defined as offset $O_s$.

For given parallel joint traces there are additional geometric characteristics. On the one hand there can be a rock bridge, whose length is denoted by $B$, between the two joint traces, while on the other hand there is an overlap length $\delta$, as shown in Fig. 2.

Fig. 2. Two cases of parallel adjacent joint traces; (a) there is a rock bridge length, $B$, between two adjacent traces; (b) there is an overlap length, $\delta$, between two adjacent traces