A NEW MODEL OF INCLINOMETER AND ITS APPLICATION IN DETERMINATION OF ATTITUDE OF FORESET PLANES

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INTRODUCTION

Study of cross-strata involves accurate measurement of orientation of the foreset planes. A number of devices have been contrived to facilitate rapid and accurate determination of orientation of surfaces (Pryor 1958; Hogue 1966; Armstrong 1967; Parizek 1967). Use of these instruments in conjunction with the Brunton Compass increases speed and accuracy of data acquisition and helps in expediting exposures not directly measurable with the Brunton Compass. These methods, however, require at least partial exposure of the actual surface. Paucity of such suitable exposure often limits the size of the sampled population and thus affects the statistical inferences drawn therefrom. In fact, a large number of foreset planes are exposed only as traces in section. With a view to increase the sample size, attempts can be made to determine the orientation of those foreset planes from their traces. A brief methodology of this measurement operation is presented here. Considering the inapplicability of the available models of attitude indicators to such exposures, a new model of inclinometer has been designed to ensure the accuracy of the method.

DETERMINATION OF ATTITUDE OF A PLANE FROM ITS TRACES IN SECTION

As mentioned earlier, a large number of foreset planes are exposed only as traces in natural sections. In general, these sections are uneven surfaces and can easily be divided into a number of planar segments of different orientation. A cross-stratified unit may thus be intersected laterally by two or more planes of different orientation. Since the foreset planes are mutually parallel or approximately so, the lines of intersection are equivalent to the traces of a plane on sections of different orientation. Orientations of two or more of such lines are determined and are plotted on a stereonet. These may be obtained either through direct measurement of the magnitude and direction of plunge of the line, or by measuring the attitude of the section and the rake of the trace on it. For curved traces (concentric cross-laminae), it is preferable to measure the attitude of the tangent drawn at the point of maximum curvature. On a stereonet the great circle passing through these points represents the plane, and the attitude can be determined therefrom. The orientations of two such traces suffice for the purpose, but three or more readings are desirable to avoid possible measurement errors and to take into account any real variations in the attitudes of cross-strata in a given set.

THE INCLINOMETER

The instrument (Fig. 1) is made up of a transparent circular protractor (15 cm diameter) with a prismatic spirit level and dipmeter affixed on it. The protractor is graduated at 0.5° intervals. The spirit level is aligned parallel to the 0°-180° line of the protractor. It is held with the help of a pair of fixed flexible clips and can be rotated about its long axis whenever required. The dipmeter consists of two 90° protractors (10 cm diameter and graduated in 1° intervals) affixed on either side of a transparent plate, and two pendulums are hung for free oscillation from the center of curvature of the protractors. The dipmeter is oriented parallel to the 90°-270° line of the circular protractor with which it is fixed with a hinge, so that it can be kept folded when the instrument is not in use. The other important components are (a) the base plate (20 cm long and 4 cm wide) and (b) two extension plates (each 10 cm long and 2 cm wide). One end (along the central line) of the base plate is attached to the center of the circular protractor with the help of a nut and bolt. One end of each of the extension plates is similarly attached at the other end of the base plate on either side of its central line. All of these plates and the circular protractor are now mutually parallel and can be rotated with reference to each other about their respective points of attachment. The transparent components (the protractors and the plates) are made up of 0.3 mm thick acrylic sheet. The metallic attachments are nonmagnetic, of brass or aluminum.

USES

This inclinometer has multiple uses in determination of attitude of linear and planar features. A brief operational procedure is presented here.

Fig. 1. - The inclinometer.