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Stereographic Projection Techniques in Structural Geology

Leyshon, Peter and Lisle, Richard, 1995. Butterworth Heinemann Publishers, Oxford, price GBP 19.99, ISBN 0-7506-2450-7

A great many undergraduate students find it difficult to visualize the interrelationships between planar and linear features in three dimensions and to represent these using stereoprojections. The recent book by Peter Leyshon and Richard Lisle goes a long way towards solving this problem. It is a large format, soft-back volume of only 104 pages that carries a price tag that will be attractive to students. I have been happy to recommend it to undergraduates as a virtually essential purchase, and in the two years of experience of using it since it first appeared it is clear that students concur with this view. The book also comes with a computer disk containing a basic stereoplotting and manipulation program (QUICKPLOT) and a collection of 'games' intended to aid visualization in three dimensions.

The book is designed throughout around a single page description of each particular concept, together with a page of well designed line drawings and photographs to illustrate that concept. Planar and linear structures are defined and methods of recording such field data are set out. Representation of these using the stereoprojection are then described. Although a systematic set of rules for plotting is given, the reader is strongly encouraged to develop a fundamental understanding of what he or she is doing so that 'cook-book' rules do not have to be remembered. A page is devoted to each of the commonly encountered applications, such as finding the plane containing two lines, the angle between two planes or between two lines, apparent dip and section construction, the difference between stereographic and equal area projections, and so on. From this point, the various techniques for the analysis of folds are described, followed by applications to the analysis of faulting and the deduction of principal stress directions from conjugate fault sets. Properties of conical surfaces are then explored, including rotation of data about anhorizontal or inclined axis. The practicalities of density contouring of data are next discussed. The final set of techniques described concerns the analysis of superposed folding.

Although each of the descriptions of the basic techniques is illustrated with reference to a typical geological example, the final part of the book provides typical examples of the analysis of 'real' folds and joint sets. In order to help develop practical skills, some 45 problem exercises (and their solutions) are given. Finally, in a set of appendices, plotting nets and other graphical plotting and descriptive tools are presented.

The QUICKPLOT software provided with the book is intended to be run under DOS, and today's students will probably find it rather unfriendly compared to modern software operated via a graphic user interface, much of which is freely available. It is not well suited to incorporation within an integrated set of software (spreadsheet, word processing, map analysis, etc.) that students might be expected to use for report preparation and development of transferable skills. Nevertheless, if one is prepared to work at it, it is a powerful package that enables all the operations described in the book to be carried out.

It would be impossible to find a book on stereoprojections about which one did not have a few gripes. I found myself irritated by the acceptance of two alternative ways to define axial surface of a fold. One is the (correct) definition as the surface containing the hinge lines of adjacent folded surfaces, but a definition as the bisector plane of the interlimb angle is also given. These are mutually incompatible definitions when adjacent fold limbs are of unequal thickness and can only serve to confuse the student.

I also feel that greater weight should be given to the use of geological maps together with the stereoplot, including emphasis of the fact that the stereoplot only displays angular relations between data, whereas spatial relations can be displayed on the map. The determination of the axial plane of folds using the measured or calculated plunge, together with the axial surface trace from the map, should be presented as a fundamental aim of the analysis of any area of folded rocks and of the relation between axial plane and cleavage or schistosity. These latter points are in fact made, but rather briefly and without the emphasis that I feel they deserve.

These points aside, the book is a very welcome addition to the armoury of the teacher of structural geology. The authors have clearly put a great deal of thought into the production of a book that is compact, inexpensive, and well structured to meet the needs of students in an area than many find difficult.

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