

folds which separate and/or have one or two sides, real fake projective spaces (surely a joke?), fake lens spaces and other goodies. At the back of the book is a notation index and very welcome it is too. Unfortunately, with all this mathematics, the material is so condensed as to be almost unreadable and some sections are particularly obscure. Indeed, one gets the impression that a lot of haste was used in the compiling of some chapters. I suspect that the labelling of theorems has been altered and some of the corresponding references by an oversight have been left unchanged. This may have been due to the fact that while the book was being prepared for publication the results of Kirby and Siebenmann which prepare the way for an attack on the purely topological case have appeared. Therefore one would like to see a follow up book in which the ideas are presented in a more accessible fashion, even if the ground covered is not so large.

ROGER FENN

## Combinatorial Analysis

*Graph Theory and its Applications.* Edited by Bernard Harris. (Proceedings of an Advanced Seminar conducted by the Mathematics Research Center, United States Army, at the University of Wisconsin, Madison, October 13–15, 1969.) Pp. viii+262. (Academic: New York and London, September 1970.) £2.35.

WORKERS in combinatorial analysis approach their subject with an endearing exuberance, born of the excitement of a relatively new and rapidly evolving field, with many applications within as well as outside mathematics. The seminar where the papers collected in this volume were presented is described by the editor as having been "one of the most colourful events in recent mathematical history"—and so it may well have been; unfortunately the colour has all but vanished in translation to print, and the papers are, chiefly, substantial technical contributions to graph theory which will be of most interest to experts and which make little concession to the general reader. Seekers after ready applications would probably require a further expository conference!

The first essay, by F. Harary, does actually set out to relate graph theory to the social sciences, but the discussion is too slight for mathematicians and social scientists alike. There is, however, a valuable survey by V. Klee on the use of circuit codes in a typical analog-to-digital conversion system, ending with suggestions for future research; another by D. K. R. Chaudhuri on the application of graph theory to the design of experiments; and an account by R. C. Read of constructing economical algorithms which can test

given graphs for certain desired properties or construct graphs of a given kind. There is a paper by Fulkerson on blocking polyhedra, which investigates the validity of the max-flow min-cut equality and the length-width inequality in this context. An article by J. W. T. Youngs analyses the important contribution that L. Heffter made (in 1891) to the Heawood conjecture, in the light of the more recent methods which led to the proof of the conjecture in 1968 (by Ringl and Youngs). A. J. Hoffman writes about eigenvalues and colourings of graphs, J. W. Moon on mapping problems for tournaments, and W. T. Tutte generalizes to matroids a connectivity theorem of his for graphs. Finally, there are two long papers: one by R. Mullin and G.-C. Rota, in which the authors develop a systematic theory of sequences of polynomials of binomial type, of which special cases have long been in use in the calculus of finite differences, and relate it to the combinatorial theory of distribution and occupancy; and one by B. Harris and L. Schoenfeld on exponential generating functions which enumerate the number of elements in certain subsets of the symmetric semi-group on  $n$  letters.

H. HALBERSTAM

## Analysis by Flame

*Flame Photometry: Laboratory Practice.* By J. Dvorak, I. Rubeska and Z. Rezac. English translation edited by R. E. Hester. Pp. 325. (Iliffe: London; SNTL: Prague, March 1971.) £4.50.

THE book is designed to provide a thorough introduction to the fundamental theory and practice of flame emission and absorption photometry. The emphasis, however, is placed quite firmly on flame emission spectrometry while atomic absorption spectrometry, with the exception of a description of available equipment, escapes with only a passing mention in most instances. Many of the basic concepts in flame photometry are, of course, common to both emission and atomic absorption methods of measurement, and an emphasis in this respect is quite acceptable; the reader, however, is left frequently with the impression that the book is somewhat out of date. The references cited are comprehensive up to 1967, but are apparently not sufficiently recent to have included the more significant advances made in both emission and atomic absorption spectrometry. For example, while the section dealing with various types of interferences is quite comprehensive with respect to emission measurements in relatively low temperature flames, it devotes almost no attention to the use

of the nitrous oxide-acetylene flame which overcomes some of these effects in both emission and atomic absorption spectrometry.

The book begins with a general introduction of little real value and then gives a brief but adequate description of the chief theoretical concepts of general flame photometric practice, for example, elementary theoretical relationships in emission and atomic absorption spectrometry, some flame characteristics and introduction of sample into the flame. The final and principal section of the book is concerned exclusively with practice, particularly in relation to flame emission spectrometry. Considerable attention is given to both individual instrumental aspects, such as burners, nebulizers and detectors, as well as complete instruments which were available at the time of writing. Another comprehensive section deals with interference factors likely to cause erroneous results. The final two chapters of this section deal with spectral characteristics of a range of elements and the determination of a more limited range in specific analytical applications such as water, silicates, minerals, ores and rocks, agriculture, biochemistry and so on. These chapters are of less importance and value in the light of current practice in flame photometry than probably anticipated by the authors at the time of writing. In consequence the book may be regarded as an interesting and concise, although not very thorough, introduction to flame photometric practice and is unlikely to find a widespread use among students or practising analysts.

R. M. DAGNALL

## Plasma Physics

*The Propagation of Electromagnetic Waves in Plasmas.* By V. L. Ginzburg. Translated by J. B. Sykes and R. J. Tatler. Second edition, revised and enlarged. (International Series of Monographs in Electromagnetic Waves, Vol. 7.) Pp. xix+615. (Pergamon: Oxford and New York, January 1971.) £8.00; \$21.50.

RESEARCH in the dynamics of wave propagation in natural ionized media has increased enormously during the last decade, when results from rocket and satellite borne wave experiments have become increasingly available. This large wealth of data has stimulated the interest of many plasma physicists in the analysis and, often, in the laboratory study of a number of geophysical phenomena. For this reason alone, this new second edition of Professor Ginzburg's classic text should be a most welcome addition to the library of any plasma physicist and, in particular,