STREETER, D. N. (1972). Cost Benefit Evaluation of Scientific Computing Services, *IBM Systems Journal*, Vol. 11, No. 3, pp. 219-233.

THURBER, K. J., and MYRNA, J. W. (1970). System Design of a Cellular APL Computer, *IEEE Transaction on Computers*, Vol. c-19, No. 4, April 1970.

WAHI, P. N. (1971). *AIMS—Applied Information and Management System—a General Management Business Simulation in APL*, Report No. G320-2066, IBM Cambridge Scientific Centre, Cambridge, Massachusetts, (April 1971).

WAHI, P. N. (1972). A General Management Business Simulation in APL, *IBM Systems Journal*, Vol. 11, No. 2, p. 169.

WILSON, R. P., and RODEN, R. B. (1973). *A Taste of APL*, University of Waterloo.

WOODRUM, L. J. (1969). Internal Sorting with Minimal Comparing, *IBM Systems Journal*, Vol. 8, No. 3, pp. 189-203.

Book reviews

Le Langage et Les Systemes APL, by G. Demars, J. C. Rault, G. Ruggiu, 1974; 322 pages. (Masson et Cie, 85F.)

This book brings to the French language reader a valuable text describing, as its title implies, both the definition of the APL language and a description of the systems aspects of the most important implementations.

The book is organised in three parts. The first is an informal account of the main ideas of APL. This is followed in part two by a detailed formal description of the language. Part three describes the ways in which the user interacts with the system, including topics such as interactive terminal use, the editing and debugging facilities, the management of the work space and the command language. This part ends with sections on APL filing systems and on possible future developments.

This organisation does lead to some repetition between parts one and two, but this was probably inevitable as the book seems intended to serve both as an introduction text for a novice reader and as a complete account of the language and its use.

The book is well supplied with in-text examples of the use of APL to solve problems of many different types. A possible criticism is the lack of examples for the reader to solve for himself.

Although the book is intended to describe APL systems and not only APL 360, a series of appendices gives complete lists of commands and error messages relevant to that system.

The writers present their material with the enthusiasm which one has come to expect from APL 'addicts', for whom the power of the language is sufficient to off-set its lack of structure and clarity. Their concluding remarks nevertheless show that the authors regard APL as it exists at present as a step along a road towards future developments in programming which will be strongly influenced by the APL experience.

S. J. GOLDSACK (London)

Computer Aided Control System Design, by H. H. Rosenbrock, 1974; 230 pages. (Academic Press, £7·50)

Among the many books on control system design published in the last twenty years, this book appears to be the first to appreciate and capitalise on the implications of readily available computers with graphic display for use in the design process. Perhaps a more important feature, which also distinguishes this book from any other, is the chapter on design of systems with multiple inputs and outputs. This is one field where use of the computer can make an important contribution. As to be expected from Professor Rosenbrock's recent research, the design problem is treated entirely from the

frequency domain viewpoint, the unifying thread being the development of concepts in the single input single output case which can be extended to treat the multivariable design problem.

To consider the book in detail, the necessary mathematical preliminaries are reviewed in Chapter 1, with particular emphasis on the technical machinery for multivariable systems. Chapter 2 deals with the design of single input single output systems. Here the book differs from other textbooks on this subject by introducing the 'system matrix' which plays an important role in the multivariable case. Some criticism must be made however that only two design methods, the inverse Nyquist diagram and the root locus plot, are considered. Many designers will perhaps be disappointed to find no guidance on the use of direct Nyquist, Bode or Nichol's diagrams. The subject of Chapter 3 is the extension of the design techniques of the previous chapter to the multivariable design problem. Much of the technical detail here is treated comprehensively in an earlier book (1970); the emphasis in the present book is on the design method. However, this is perhaps not taken far enough in that no systematic procedure is immediately obvious, but rather the designer must sift amongst a wealth of stability results in order to build his 'design algorithm'. A study of the nonlinear case using the circle criterion is made in both Chapters 2 and 3. A highly commendable feature of the book is Chapter 4, which studies in some depth four industrial design problems using the techniques described in Chapter 3. In addition, the book has a considerable number of exercises throughout the text, and some thirty problems at the end of both Chapters 2 and 3, making it extremely suitable for use as a teaching text. However, from the mathematical details one must assume that the book is directed towards the graduate rather than under-graduate student.

As to be expected perhaps from a book of this length, from the computer-aided design viewpoint it does not give any guidance on the construction of efficient interactive programs or the selection of suitable numerical algorithms, which for some people may cause the book to fall short of expectations aroused by its title. From the control theory viewpoint, a criticism lies in the lack of discussion of any other available multivariable design method, such as non-interacting control, the sequential return difference method, and the use of characteristic loci.

In all other respects, the book is without fault and is of great value as a means of learning the concepts involved in practical design problems and their solution using the frequency domain. It is true to say that many people believe this to be the only realistic approach available to deal with many of these problems.

ROSENBROCK, H. H. (1970). *State Space and Multivariable Theory*, Nelson.

M. J. DENHAM (London)