4. Conclusion

The Data Base Management System Samhita makes an attempt to enforce some discipline on the data base user. This is done in the following directions:

(*a*) The network structure envisaged makes the data base more intellectually manageable

(*b*) The Data Manipulation Language minimises side effects in handling record and set currency

(*c*) The concept of the data base key has been replaced by that of an internal system of pointers inaccessible to the user. At the same time, it is possible for the user to maintain multiple positions in the data base without tampering with record pointers. A potential source of errors is thus eliminated from the Data Manipulation Language.

References

CODASYL. (1969). *Data Base Task Group Report.*
CODASYL. (1971). *Data Base Task Group Report.*
DATE, C. J. (1976). An Architecture for High Level Language Data Base Extensions, *Proc. Int. Conf. on Management of Data (SIGMOD).*

Book review

Programs for Digital Signal Processing edited by the Digital Signal Processing Committee, IEEE Acoustics, Speech and Signal Processing Society, 1980. (*John Wiley*, £18·00)

This collection of ANSI FORTRAN programs in digital signal processing represents the fruits of a four year project undertaken by a distinguished group of specialists active in the field. A broad spectrum of programs is included covering both applications and design techniques. Each program has been subjected to comprehensive tests by reviewers located at sites in the USA, Canada, Mexico, UK and Continental Europe using the programs on a variety of machines and inevitably a variety of FORTRAN compilers. To facilitate this all programs are written in ANSI PFORT and all machine dependant quantities are specified in the PORT library. Values required for use in the function subprograms related to a large number of machine types (all American) are given in an Appendix.

The editors and authors have given particular attention to uniformity and standardisation of programming method. For example, the standardisation of format by renumbering all statement labels by inserting CONTINUE statements to force every DO statement to end on a unique CONTINUE statement and by systematically spacing and indenting each statement in a program. All programs are liberally and clearly commented with an initial statement describing the function, with bibliographical references if required, and further COMMENT statements throughout the program. There should be no difficulty in following the logic and path structure of any of these programs. This is more than a mere collection of 'other peoples' programs' however. Each chapter includes its own introduction and review of methods, providing a readable tutorial in signal processing techniques. Good bibliographies are given which include key papers in each subject.

Of particular value are the set of Fast Fourier Transform routines selected and edited by no less an authority than J. W. Cooley. Several of these have not previously been published, although all have been most thoroughly tested and edited. Some of the FFT programs are very fast, obtained at the expense of instruction memory and programming complexity. Others take advantage of symmetries in the data to save computation. Mixed radix programs and optimal mass storage routines are included. Sizing, timing and accuracy of these FFT's have not been neglected and are well summarised in tables included at the end of this chapter.

Only four programs are included in the chapter on Power Spectrum Analysis from the many that have appeared in earlier IEEE publications. However, the four chosen cover the periodogram, correlation, coherence and cross-spectral estimation and are sufficiently flexible for most requirements. All are well documented and the excellent introduction gives several examples of use.

The chapters on high speed convolution, FIR and IIR digital filtering will be much thumbed by those with filtering problems—and this applies to everyone who has digital signals to process! The high speed convolution program utilises the well known overlap—add technique due to Stockham. The most important of the FIR filter programs uses the Remez exchange algorithm, which has wide use. Others use classical methods including the windowed linear phase filter permitting program choice of no less than seven windows.

Programs chosen for inclusion in the chapter dealing with IIR filters reflect the general design problem of nonlinearity in the filter coefficients compared with the linear FIR filter case. There has been considerable publication of IIR program designs in the last decade, many having particular advantages in specific cases. The filter programs included here are general purpose programs representing ease of use rather than fast operation. This is probably optimum for the type of researcher who will use this book. The programs are among the largest documented programs included in the book, but are designed to provide much information on performance, e.g. noise figures, as well as allowing optimum design parameters to be selected for the reader's application. It is surprising to find routines included to permit plotting of filter characteristics on the line printer since few scientific installations fail to contain better graph plotting devices.

The remaining chapters contain much useful information as well as programs on Linear Prediction Analysis of Speech Signals, Cepstral Analysis and Interpolation and Decimation. This last contains a useful set of programs on the fundamental operations required in digital signal processing which are sufficiently well thought out and documented to deter any researcher from writing his own routines.

It is to be expected with a collective work of this size, taking several years to produce, that some omissions will be felt, particularly as one would wish to see other topics treated with the same thoroughness and attention to standards. It would be nice to find included sets of programs for Walsh and related transform analysis, spectral analysis by Pisarenkos maximum entropy methods and some general programs on 2-dimensional analysis (although Singleton's 2-dimensional transform program is included). The only regrettable omission in the reviewer's view is the absence of IIR filter programs using the Bi linear Z-transform which enables almost any continuous filter function to realise its digital equivalent.

In summary this book represents a remarkable and valuable addition to the signal processors' library, produced at an extremely reasonable cost for the amount of effort and thought that has gone into its preparation. The members of the Digital Signal Processing Committee of the IEEE Acoustics, Speech and Signal Processing Society are to be congratulated on a fine result which will make the task of processing digital signals considerably easier for many in the years to come.

K. G. BEAUCHAMP (Lancaster)