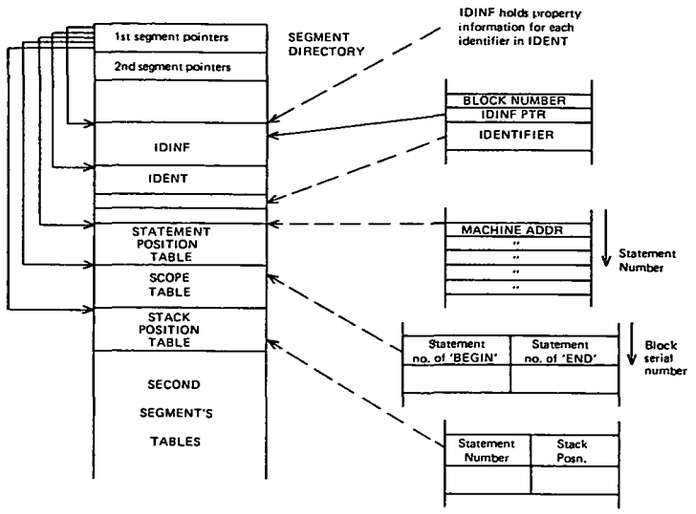

Fig. 4 Program map file format

Identifier information table

The second word of the IDENT table contains a pointer to the relevant entry in this table, which contains property information for all the identifiers in the program. The table is written by the third pass of the compiler, by which time all relevant information about the identifier is known, and addresses are in their final base-displacement form.

Statement number table

This is a simple list of the address of the machine instructions corresponding to each statement number. It is used directly to find the address at which to insert a patch, etc. When a fault is detected in the user program, the address of the fault is handed back to the debug, and the statement number table is searched to find the corresponding source statement so that the user may be informed.

Stack position table

The need for the stack position table arises because the Argus 700 has a hardware stack. Items on the stack such as parameters of procedures are addressed relative to the stack pointer register SPR. Thus the displacements of such parameters may vary from place to place within a procedure (e.g. due to 'FOR'-loop control words which are held on the stack). The table gives the number of words on the stack at the start of each source statement. Statements for which this number is zero (the majority) are not listed in the table.

5. Conclusion

The DDS system was written in CORAL, and was initially implemented on the Ferranti Argus 500. Testing was carried out in an environment which simulated the software system of the Argus 700. These tests demonstrated that the fundamental design of the system was sound, but at the time of writing the final versions had not been tested on the Argus 700 due to the absence of certain other necessary pieces of software. Thus it is not possible to describe any practical experience gained with the system.

The design and development of DDS to the stage described above has occupied one man-year of effort. It is expected that the system will be fully operational by the time this paper appears.

Acknowledgements

The author wishes to thank his friends and colleagues at Ferranti for their help and advice during the project and in the preparation of this paper. Particular thanks are due to P. Bayley, D. J. Pearce, and H. B. Williams.

The referee's helpful comments and advice were also much appreciated.

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Book review

Computational Methods for Matrix Eigenproblems, by A. R. Gourlay and G. A. Watson, 1973; 132 pages. (*John Wiley and Sons*, £3·50.)

This book is based on lectures given by the authors to M.Sc. and undergraduate students at the University of Dundee. Its aim is to provide a suitable text for courses on the numerical solution of matrix eigenproblems. The intention is to present the more commonly used and reliable techniques in a concise, straightforward manner, without any detailed error analysis but stressing where necessary the dangers of unsuitable methods. The student thus obtains a good overall view of the subject which, for a fuller appreciation of any topic, would need to be supplemented by further reading in more advanced texts.

The book contains fifteen short chapters. The first three illustrate how eigenvalue problems can arise in practice and give the required background theory and transformations for later use, including material on the solution of linear equations. The next three discuss the power method (including inverse iteration and simultaneous iteration using a number of trial vectors) and these are followed by three further chapters dealing with the methods of Jacobi, Givens and Householder for Hermitian matrices, and the Sturm sequence and inverse iteration procedures for calculating the eigensystem of a real symmetric tridiagonal matrix. Application of the QR algorithm to the latter problem is discussed in Chapter 10 (the LR algorithm gets only very brief mention here) whilst Chapter 11 touches on extensions of Jacobi's method to general matrices. Reduction to upper Hessenberg form and use of subsequent techniques, including in particular the QR algorithm, are considered in Chapters 12 and 13. Generalised eigenvalue problems are mentioned in Chapter 14 and the last chapter discusses (very briefly) available implementations of the methods described in the book.

The ground covered by the book is conventional and the treatment of necessity rather terse due to the book's shortness. A number of exercises are given for the student at the end of each section and the methods discussed are frequently illustrated by simple examples involving matrices of order three or four. (In one of these examples (on page 125) spurious elements appear somehow to have crept into the last row of the matrix during the final stage of a reduction to upper triangular form which preserves information on the determinants of the principal minors.) Little prior knowledge is assumed of the reader apart from a basic familiarity with the fundamental concepts of matrix algebra, such as multiplication, inversion and determinants The book is therefore suited to a wide audience and provides a short and uncomplicated introduction to the numerical techniques which have proved most successful for the matrix eigenproblem. In so doing the authors' goals have been well achieved.

E. L. ALBASINY (Teddington)