carried out, and the address of the first of the relevant parameters. It is then a very simple matter to provide the options necessary for repetitive work, namely, a conditional jump option, and means for resetting directory entries and groups of parameters. The user is then able to carry out a kind of second-order programming, which is very convenient when, for example, a mathematical operation involving several parameters is to be repeated on several sets of similar data.

Discussion

The self-service system described above differs in some respects from the version which has been developed for the Mercury computer, but agrees closely with that in process of development for the KDF 9. The degree of elaboration of the system is a matter of preference, because there is no inherent limitation in the design, but it may be mentioned that nearly all the work of the long-range forecasting unit, both research and operational, is carried out with one program which has fewer than 100 options, using directories which rarely, if ever, exceed 30 items in length. The task of writing directories, or second-order programming, is thus very much easier than that of basic machine-code programming, and can with advantage be taught to and carried out by more people. The routines themselves are written to provide the maximum protection against errors in the data, or mistakes in programming, by arranging that if ever the computer is called on to carry out an operation which is mathematically impossible, or likely to lead to a physically unreasonable result, then it will record that result as a missing observation, and go on to the next stage. Thus a computation once undertaken is almost certain to produce results of some kind, of which some part may be useful even though other parts are missing or obviously wrong.

It is not quite true to say that a user can use this system with no knowledge whatever of the computer, because obviously, he must keep within the limitations of the existing storage space, but the knowledge necessary to do this is far less than that required in any conventional programming system. This system of operation is not suitable for purely casual use, for the basic effort in machine programming is not trivial; but for the worker who intends to carry on continued work within a fairly well defined field, there is no system which offers greater returns for less effort. The routines which have been developed already, and the operational details, can, of course, be made available to any prospective user.

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Book Review

Invariant Imbedding and Time-Dependent Transport Processes, by Richard E. Bellman, Harriet H. Kagiwada, Robert E. Kalaba and Marcia C. Prestrud, 1964; 256 pages. (Barking: *Elsevier Publishing Company Ltd.*, 55s.)

This is the second volume of the series *Modern Analytic and Computational Methods in Science and Mathematics*. The first entitled *Invariant Imbedding and Radiative Transfer in Slabs of Finite Thickness*, by Bellman, Kalaba and Prestrud, considered the determination of the reflected flux due to plane parallel flux incident upon an isotropic, possibly inhomogeneous, slab of finite thickness. The present volume, meant to be self-contained, deals with the determination of non-stationary reflected fluxes, and comprises some 40 pages of text, some 20 pages of FORTRAN programs and nearly 200 pages of tables and graphs !

Chapter 1 describes a simple technique for the numerical inversion of Laplace transforms, applicable when the inverse sought is known to be a rather smooth function, and not particularly convincing results are given for four test cases.

This is followed (Chapter 2) by discussion of an idealized one-dimensional neutron multiplication process, using invariant imbedding to derive a non-linear integro-differential equation for the time-dependent reflected flux, the Laplace transform to simplify it, and the numerical inversion procedure to obtain the tabulated solutions.

Finally, in Chapter 3, which leans heavily on Volume I of the series, the foregoing techniques are applied to time-dependent diffuse reflection from a slab, complete numerical results being presented in Appendix 1. Appendices 2–9 contain tables relating to the numerical inversion of Laplace transforms, while Appendix 10 contains the FORTRAN programs.

There are few mistakes in the book but the mathematical presentation is slack and disjointed, and the content hardly worthy of publication on its own in this form. The reproduction of the tables, some in fixed-point and others in floating-point form, is uneven and their precision, and hence their usefulness, sometimes doubtful. Altogether a disappointing work from such a distinguished source.

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