

received; and statistical control had been used for many years. There were some well-known examples of which Dr. Douglas would doubtless be aware.

The problem of flexibility in developing programs had been mentioned and he wished to draw attention to the great flexibility which could be achieved with a system of report generators. The reports which were produced for management on a regular routine basis were produced to a daily, weekly or monthly schedule, and when additional information was called for, the report generator program was used and it was possible to assemble the required information. Here an electronic computer was particularly flexible and was one way in which computers could be sold to management.

Dr. Douglas said there was a great deal in what had been said by Mr. Dilloway. He himself was aware of the difficulties within a firm and appreciated that it was desirable, in some cases, to allow things to grow from individual operation. But he would like to go a little deeper and look to the future in another area. The time scale on which information was passed to management was being changed and inevitably this would mean in the long term a complete change in the structure.

He did not believe that fragmentation into individual departments would necessarily survive in its present form once the computer system started to take over. With a centralized system the actual dimensions would start to change. The dimensions of a firm were very largely based on the amount that one man could effectively control through perhaps four or five others; and that whole situation was to alter.

There would be alterations in information, though at the present stage it was not possible to prophecy in what form. With such a changing situation very different ideas might grow up about centralization and the size of the individual units. Over the next few years these ideas might alter quite radically much of the operations of firms. It was not possible accurately to foresee what would be the overall effect, but from what was to be put into their hands, managements might get tighter control of their own business.

All this would mean an entirely different problem for management, something quite different from anything that had happened before. It was not only a change in the nature of doing things but a more substantial alteration and consequently he was not convinced that in the long run the barriers now thrown up round individual sections could be maintained, or that that would be advantageous.

Thought must be given to the central machine to go in, and how its arms were to stretch outwards; this raised the question of transmission speed. At present the amount of information obtainable overnight was less than one could get through the post in an envelope in the same time. In the U.S. the aeroplane had become a relatively cheap and fast data-transmission system. Data had been flown to New York for processing and flown back within 48 hours. There must be some bold thinking on all these aspects.

The Chairman, on behalf of those present, thanked Dr. Douglas for undertaking the lecture at short notice in place of Mr. T. Cauter, and for presenting it in so lucid and stimulating a fashion.

Book Review

Analogue Computation, by STANLEY FIFER, 1961. 4 vols., 1,331 pages total. (McGraw-Hill Book Co., Inc.)

This book, in four volumes, is intended to provide a complete course of instruction in analogue computing techniques at graduate or near-graduate level. The accent generally is on methods of computing rather than how to design computers, but even so, about a third of the book is devoted to describing and analysing equipment in order to give a proper understanding of machine limitations and sources of error. The care with which the author has defined his terms (e.g. "precision" and "accuracy") and the way the material has been arranged make this a good text-book for use in training establishments, particularly where an analogue computer is available to supplement book-work with practical work.

The first two volumes take the d.c. voltage analogue computer as an example and introduce first the units giving linear operations (summation and integration), then the methods of solving linear differential equations with these units. This is followed by a description of non-linear units (multipliers, resolvers, etc.) leading to a discussion of the solution of non-linear and variable-coefficient differential equations. Function generation by analytical series, transfer-function concepts and checking procedures are also covered. The text contains examples of various problems (e.g. interceptor kinematics) worked out in detail with their computer set-up, in order to demonstrate preferred computer arrangements and methods of scaling. Each chapter is followed by a reading list and problems (practical as well as theoretical, but no answers).

Volume III describes other types of analogue computer (a.c., network analyser, mechanical differential analyser, etc.) with typical problems for which they are suitable, although the treatment is not as exhaustive as in the case of the d.c. voltage analogue with which they are compared. In addition, the application of analogue computers to algebraic and partial differential equations is discussed.

Volume IV deals with advanced techniques which are necessary for many practical problems, for example harmonic analysis, noise, time delay and sampled-data control systems; a considerable amount of space is given to the dynamics of flight and flutter.

In view of the careful treatment of the subject there are one or two surprising (though minor) omissions. The importance of a stable reference, the effect of integrator capacitor imperfections on the harmonic oscillator simulation, and possibly some discussion of self-optimizing systems, could have been included with advantage.

The standard required to cope with Vols. I, II and III is covered in science and engineering graduate courses; the mathematics needed for Vol. IV may be a little more specialized in certain respects, but adequate references are given. The progression from Vol. I to Vol. IV is smooth, with a fine balance of theory and practice which should make for a good, if intensive, analogue computing course.

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