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Book review

Finite Automata, by B. A. Trakhtenbrot and Ya. M. Barzdin, 1973; translated from the Russian by D. Louvish, 362 pages. (*North-Holland*, Dfl. 60.00.)

This book describes the theoretical aspects of finite automata and their relationship to languages and *w*-languages (i.e. languages containing infinitely long words.) Starting with elementary definitions and theorems the authors go on to describe various properties of finite state languages. There is a comparison of meta-languages for finite automata and a description of current work on the identification of automata from input/output information.

Chapter 1 contains a description of outputless automata and the properties of their corresponding languages under various operations such as concatenation, iteration and the less well-known operations of projection and cylindrification. Transition graphs are introduced and there are short sections on probabilistic automata and the grammars of finite state languages.

In the second chapter automata with outputs are discussed including equivalence and decision problems. McNaughton's infinite game analogy is used to show the correspondence between operators and finite automata. In particular, it is shown that certain operators are not realisable as automata.

An account of languages for specifying automata is given in Chapter 3. This includes a description of the meta-language I which is based on propositional logic. A comparison of meta-languages demonstrates that I is the most powerful yet devised. Synthesis of automata corresponding to given descriptions is also discussed.

The last two chapters, written by Barzdin, deal with the problem of automata identification given only input/output specifications. This part of the book contains several previously unpublished results involving statistical estimation of automata parameters. These results have applications in other fields such as syntactic pattern recognition.

Although the book contains a good introduction in which the main concepts are explained carefully it is not really suitable as a first course in finite automata theory since the mathematical approach may be unfamiliar to many readers. However, it will be interesting to those who have a basic knowledge of automata theory or a mathematical background. The presentation is concise and each chapter contains supplementary problems for the reader to consider.

English readers may have difficulties with the terminology (for instance, what is usually called a finite state acceptor or recogniser is referred to as an anchored automaton) but the translator's notes are helpful as are the notes and references at the end of each chapter.

R. H. Kemp (Leicester)

Discrete Models, by D. Greenspan, 1973; 165 pages. (*Addison-Wesley Applied Mathematics and Computation Monographs*, US$16.00 hard cover, US$8.50 paperback.)

This is a disappointing book. The subject of discrete modelling or, more specifically, computer simulation of physical processes is a fascinating one and there are a number of important principles that can now be enunciated. But in his simplistic approach the author has gone too far in denying the usefulness of the concepts of limit, derivative, etc. and hence of continuous models. As a result he has all sorts of problems in trying to analyse the behaviour of his discrete models and has to present each as an inspired guess rather than the result of rational design.

For example, on page 9 stability is defined for an initial-value problem yielding $y_i = 0, 1, 2, \ldots, n$, as each $|y_i|$ being less than the largest number that can be held by one's computer! Such a vague, empty concept can hardly lead to much understanding or discrimination. On pages 11, 12 a particular and non-obvious choice of difference replacements for velocity and acceleration leads to equations for the one-dimensional motion of a particle which obey discrete momentum and energy conservation laws. Not until page 103 is it conceded that this can be done in other ways and a more symmetric scheme is given which is 'inherently more stable, and hence more economical'. A 'stability' analysis for a non-linear oscillator is given on pages 25-28 based on the behaviour as $n \to \infty$, but this fails to distinguish the vital difference between this limit and that in which $n \to \infty$ as $\triangle t \to 0$ so that $n\triangle t \to t$, nor that between linear and nonlinear problems: moreover, it is incorrectly claimed that such analyses, based on energy methods, do not appear in standard texts.

It is indeed unfortunate that such absorbing topics as Nonlinear String Vibrations, Planetary Motion and Discrete Newtonian Gravitation, the *n*-Body Problem and Discrete Fluid Models are so superficially treated in this book.

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