

thermoelectric converters, magnetohydrodynamic generators and fuel cells.

In the chapters on heat transfer, the conduction section has been enlarged, and the convection section deals in much more detail with the mechanics of boiling. All these additions are considerable improvements.

The printing of the new edition appears to be slightly smaller and better in this newest edition; the lines are a little farther apart and the pages larger. The whole effect is pleasing and inviting to the reader. The number of pages has increased from 559 to 601.

The book is the best general textbook for undergraduates learning thermodynamics to degree level and is a very useful reference book for graduates working in other fields. The authors have struck a relationship between the purely scientific and the practical that seems to suit the engineering academic very well.

RUSSELL HOYLE

JOURNAL FOR MATHEMATICIANS

Journal of Engineering Mathematics

Vol. 1, Number 1 (January 1967). Pp. 86. (Groningen: P. Noordhoff, Ltd., 1967.) Subscription per volume \$16.50, postage included.

THE work in applied mathematics in the many outstanding educational and research institutions in the Netherlands is of great importance in both volume and quality, and it is good to see that this work will in future be readily available in a convenient form through the *Journal of Engineering Mathematics*, being published on a quarterly basis from April 1967 onwards. Although this is almost entirely a Netherlands initiative in respect of publishers, editors and authors of the numbers so far available, papers will be published exclusively in English (preferred), German and French.

It is also good to see the emphasis on application of the mathematics to practical problems in the engineering industry made both in the journal's title and in the statement of policy on the inside cover, which reads: "The aim of the journal is to promote the application of mathematics to engineering problems and to stress the intrinsic unity of the fundamental problems of different branches of engineering varying from basic principles of physics and mechanics to management and computer science."

These aims are very close to those of the three year old Institute of Mathematics and its Applications in the United Kingdom. In both cases they stem from the need to help the growing body of applied mathematicians in industry and government (in graduates alone, more than four thousand in the United Kingdom and increasing at 5 per cent per annum), and those in universities and technical colleges, to become more creatively aware of each other's work: especially, it is desirable that the best modern mathematical techniques and principles for applying them be made known to those in industry, and, also, that the researches of those in academic life become closely related to the needs of industry and government, including, of course, their long-term needs.

Journals like the Netherlands *Journal of Engineering Mathematics* or the British *Journal of the Institute of Mathematics and its Applications* can contribute valuably to all this in three ways. First, they can, and should whenever possible, elicit papers from mathematicians working in industry, which will make known characteristic types of mathematical problems with which industry is faced. Secondly, they should encourage applied mathematicians in academic life to submit papers in which the work's practical aims and relevance are clearly set out. Thirdly, they should seek from all appropriate quarters survey papers which will indicate the state of the art in particular (and especially the newer) fields of application of mathematics, or in particular areas of mathematical technique.

There is inevitably a transition while such a journal is getting under way, during which some of the older type of "academic" applied mathematics gets published. Before the journal becomes well known, there are problems of filling up numbers, which militate against rigorous selection from among the papers submitted. Experience with the *Journal of the Institute of Mathematics and its Applications* shows, however, that provided a substantial number of papers of the right kind are included from the outset, it is increasingly possible, by soliciting both appropriate surveys and also papers from mathematicians in industry and government, to build up a journal that can be more and more of an influence for the creative application of mathematics to the practical problems of industry.

It is evident from the first two numbers of the *Journal of Engineering Mathematics*, edited by Dr H. W. Hoogstraten of the Technological University of Delft, that the journal will indeed develop along these lines. Problems treated have been chosen not because the mathematics are "elegant", but because they will give the centring force between the rotor and stator coils of an electrical machine at each offset position, or because they will indicate limiting factors on the hydrological performance of water supply systems in one of the Frisian islands, and the results are given in appropriate numerical and graphical detail. There are also good papers from noted Netherlands schools of the mechanics of fluids and of solids.

At the same time, it will in addition be necessary to seek out papers from those who are applying mathematics in industry itself. Wherever possible, it should be made clear, furthermore, that papers from academic institutions should show unambiguously the practical significance of the work submitted. In these conditions, the journal should develop into one of great value to those all over the world engaged in the application of mathematics to the problems of engineering industry.

M. J. LIGHTHILL

OPERATIONS RESEARCH

Introduction to Operations Research

By Frederick S. Hillier and Gerald J. Lieberman. (Holden-Day Series in Industrial Engineering and Management Sciences.) Pp. x+639. (San Francisco and London: Holden-Day, Inc., 1967.) \$13.75.

THE techniques of operations research belong in the main to the mathematical sciences; the practice of these techniques is an experimental science. In some subjects with similar characteristics there is abundant material for laboratory exercises of all grades of difficulty to amplify and illustrate the various stages of the theoretical teaching, and these practical exercises can be presented concurrently with the formal teaching. In fields in which the experimental material is derived from case studies from life the student needs familiarity with, if not mastery of, a sufficient number of techniques to gain full benefit from the practical study. Operations research is predominantly of the latter kind and texts are necessary to present the basic methodology.

Any author of such a text has a wide choice of the amount of mathematical preparation and degree of sophistication he will require of his readers. Professors Hillier and Lieberman have purposely made slight demands in their introductory book; they ask for some familiarity with elementary calculus and for the level of mathematical maturity which usually accompanies such knowledge. In all but a few places (notably in the last section in more advanced topics in mathematical programming) the mathematics is elementary; proofs are often omitted or outlined, there is no insistence on rigour, and space is given instead to illustrations of the implications of the results. This approach has much to commend it; the students reading books on operations research are likely to have had little previous contact with the