

lication in a certain sense marks the end of an epoch, for the linearized theory has reached the stage of completion, in the sense that it is now possible to formulate and to solve almost all the problems which can be usefully tackled by means of this theory. Further advances inevitably and reluctantly will almost certainly be made by means of non-linear theories.

It is well known that the essence of the linearized theory consists in retaining only those terms which are of the first degree in the disturbance velocities, the pressure excess and the density variation which are produced by the passage of an aircraft or a missile through still air. The enormous advantage of the linearized theory is that it is possible to bring to bear all the methods of classical mathematical physics and, in particular, the powerful methods of potential theory and of wave theory. What makes the subject particularly exciting is that in the supersonic range all the concepts and methods of classical potential theory need considerable revision, and that progress is scarcely possible without employing some mathematical methods equivalent to Hadamard's theory of the finite part of divergent integrals. The use of Heaviside transforms and Fourier integrals can also be employed with great effect. The present volume gives a complete and self-contained account of all the mathematical techniques which are required in the solution of linearized equations and, in particular, of the important integral identities discovered by the author in collaboration with F. Ursell.

After an introductory chapter which carefully analyses all the assumptions involved in the linearization of the equations of motion, the author proceeds to discuss in the two following chapters the general solution of these equations for subsonic flow and for supersonic flow. He then gives a number of corollaries related to the boundary conditions, aerodynamic forces, uniqueness of solution and the interesting flow reversal theories.

The second part of this work is concerned with a number of special methods. First, the subsonic flow past thin bodies is discussed with special reference to the developments of the Prandtl-Glauert rule.

Then the author discusses supersonic flow past nearly plane wings. Here the pioneer work of Esvard is extended so that these problems are reduced to the solution of a number of integral equations of Abel's type. This is followed by a study of conical fields in supersonic flow which follows admirably the exposition given by the author and Prof. S. Goldstein. A whole chapter is then devoted to the application of operational methods, with special reference to the flow past quasi-cylindrical ducts and to axially symmetric free jets.

The final section of this work is concerned with the slender-body theory. First of all, the author summarizes the familiar results for the flow past bodies of revolution, and then discusses the generalization of these results to bodies with arbitrary cross-sections. Here the results are obtained by direct solution of the wave equation and not by the operational methods by which they were originally discovered. To many readers the direct solution of the wave equation will seem to be a distinct advance. These methods are then applied to winged bodies of revolution, giving the effects of wing-body interference.

There can be no doubt that the present volume is a most welcome addition to the series of Cambridge monographs and that it will long continue to have a

permanent value as an authoritative account of the linearized theory of steady high-speed flow. No mathematical difficulties are overlooked, and the physical significance of the mathematical equations is always kept well in mind. Perhaps some readers will put down this volume with a certain sadness—it deals so completely with the linearized theory that nothing seems to be left to be attempted by research workers but a few special problems and the great challenge of second-order theories and the full non-linear equations of compressible flow.

G. TEMPLE

RESEARCH AT HARWELL

Atomic Energy Research at Harwell

By K. E. B. Jay. Pp. xii+144+19 plates. (London: Butterworths Scientific Publications, 1955.) 5s.

AS stated in the introduction to the book, this report carries forward the story of the Atomic Energy Research Establishment, Harwell, from the point at which it was left in a previous publication¹, and also contains some material which, either for reasons of secrecy or lack of space, could not be included in the first account. It is divided into two parts: the first, written primarily for the non-technical reader, deals with the major programmes of the Establishment, while the second, for the scientific reader, attempts to treat in more detail certain selected aspects of research at Harwell.

If one compares the two parts of the volume, it appears that Part 2 rather misses its target. The difficulty of giving in sufficient detail, in such a short space, an account of the many interesting fundamental researches being carried out at Harwell is well-nigh insurmountable, and it might have been better to give a more general description together with a list of topics and the appropriate references to the published literature.

Part 1, on the other hand, contains a very interesting and readable account of the major programmes in applied research. Beginning with a brief explanation of the relation between Harwell and the Industrial Group², there follows an excellent account of the progress made in reactor design and of the problems remaining to be solved if electrical power is to be produced economically from nuclear energy. Chapter 3 gives a clear picture of the increasing use of radioactive isotopes in medicine, research and industry, and of the large part played by Harwell in this process. There follow chapters devoted to other aspects of work at Harwell, to the relations between the Establishment and British universities and other research institutions, while last, and by no means least, an outline is given of some of the human and administrative problems involved in the running of an organization of this size. In addition to diagrams where necessary, there is a number of excellent photographs.

The author has contrived to give, in a short space, a good account of what goes on at Harwell, and the publishers are to be congratulated on producing this volume at such a low price. To those who, like the reviewer, believe in getting value for their money, this volume may be safely recommended.

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¹ "Harwell—the British Atomic Energy Research Establishment, 1946–1951" (London: H.M.S.O., 1952).

² "Britain's Atomic Factories", by K. E. B. Jay (London: H.M.S.O., 1954).