

REVIEWS

Proceedings of the Symposium on Naval Hydrodynamics. Edited by F. S. SHERMAN. Washington: National Academy of Sciences—National Research Council, 1957. 444 pp. \$5.00.

This 'book' consists of a compilation of fifteen invited papers read at a large meeting in Washington, D.C., which was held in September 1956. Included also is a record of comments from the floor and the Symposium Banquet address.

The result is a decidedly mixed bag, with topics of such range that it is impossible to summarize, short of listing the entire table of contents. As is usually the case with such publications, no unity of notation is imposed by the editors, each article is complete in itself, and the whole reads rather like an issue of *Reviews of Modern Physics*. Although the publication of proceedings of symposia of some kinds is open to criticism (*J. Fluid Mech.* 4, 1958, 439), we have here a nice demonstration of both pros and cons, with the balance perhaps tipping slightly towards the former.

The articles themselves are surveys (as invited), few of them presenting really new work. This has a value in itself because low-Mach-number fluid dynamics is not well endowed with up-to-date reviews of the state of various aspects of the art. However, an article which was designed as a 45 min verbal presentation is far from ideal as a written review. Presentations are necessarily incomplete, both in range of subject matter and details of treatment. The latter weakness can be overcome by cross-reference to the valuable and fairly extensive bibliography accompanying most articles. The former is not quite so damaging as might be expected because here the printed version of the discussion following each paper frequently indicates the more important gaps and fills out the bibliography. The discussion has been heavily edited from its original from-the-floor character—in places to the ludicrous extent of writing in the passive voice—and, although still interspersed with trivialities, represents an important addition to the volume.

After a nice tribute to Captain H. E. Saunders, U.S.N. Ret., the godfather of American Naval Hydrodynamics as a science, the volume opens with the after-dinner talk given by Milne-Thomson. This talk, which had to be heard to be believed, must have been designed quite literally to end all after-dinner talks. As given, with aid of a small portable blackboard (with two admirals in attendance as erasers), to an audience most of whom were 'posted' behind three-foot dining hall pillars, it amazed more people than it enlightened. As written, however, it is a nice presentation of the point of view of the practitioner of analytical mechanics.

There follows a discussion by Lighthill of 'River waves'. This article, written with that author's usual entertaining lucidity, is one of the finest in the book and one could only wish that it were expanded beyond the scope of the address so that the discussion of cnoidal waves, flood waves with friction and kinematic waves could be followed in detail without the necessity of repeated reference

to other publications of the Manchester group. Even as it stands, however, the article serves as an invaluable introduction to the subject of river waves. The discussion following is of interest for the clash of opinion between Lighthill and Stoker. The former seeks to understand the principal mechanisms by obtaining good solutions to idealized models. Stoker obtains accurate predictions of thoroughly studied real rivers by feeding exact equations and a multitude of empirical constants into a large computer. Such methods are currently popular, and of considerable practical use, but I doubt if they give the insight which is gained from analytic rather than numerical solutions.

The third paper is a presentation by Munk, Tucker and Snodgrass of 'Remarks on the ocean wave spectrum'. Unlike most of the other papers, some new results are given here. The most interesting of these is the measured spectrum of sea-level elevation at La Jolla. Although complicated to some extent by shore effects, this spectrum is of considerable interest and utility, and indicates the complexity of free-surface phenomena. The paper also contains some useful ideas on the measurement of waves, and valuable emphasis on the two-dimensional character of surface waves.

There follows an article by Weinblum on the 'Contribution of ship theory to the seaworthiness problem'. In many ways this is the most satisfactory paper included. It is a true review, and has been considerably expanded beyond the limits of the oral presentation (it occupies 37 pages—nearly twice the average). After a fairly comprehensive, if somewhat superficial, review of present knowledge, the conclusions and most glaring gaps are neatly arrayed for us.

Paper V, on 'Wave resistance of thin ships', by Wehausen, is also a characteristic review. I am not qualified to judge its completeness, but the paper and particularly the discussion show how very far there is yet to go before ship design can be said to be a science rather than an art, at least so far as wave resistance is concerned.

This point is further emphasized by Niedermair in a brief outline of what he calls 'Hydrodynamic barriers in ship design'. He also calls attention to the naval, as opposed to purely civil, requirement for low noise which so greatly complicates the problem of obtaining higher speeds by brute force.

Paper VII, 'On the development of the theory of marine propulsion', by Lerbs, is less general than the title indicates. It is a discussion of the theory of propellers, with particular emphasis on the interaction of propeller and hull. Together with an unusually detailed discussion, the paper gives, to this reviewer at least, an eye-opening revelation of the state of this subject and the extent to which the complications of multiple wide blades in an asymmetrical flow are becoming amenable to theoretical treatment. The comment by Silverleaf, to the effect that propeller designers often do better by purely 'empirical' methods, is suitably chastening, however.

Paper VIII, by Parkinson, is something of a departure and serves as a transition between the earlier articles, in which water is considered to be a continuous, incompressible, often irrotational fluid, and the later ones where compressibility and cavitation effects are considered. It is an interesting discussion of modern attempts to base high-speed aircraft on water, using stepped

hulls, skis and foils. One suspects that the obscuring hand of security classification has held some things back, but the paper is none the less informative and readable.

There follows a discussion by Cox and Maccoll on 'Recent contributions to basic hydroballistics'. This subject is such a complex one, involving all the complications of ordinary flow past a bluff unsymmetrical body, plus those of a free surface and a partially ventilated cavity, that it is a wonder that any theory exists at all. In fact Birkhoff, in his remarks following the paper, seems to doubt that one does. Nevertheless, the paper shows that serious attempts are being made, and the comparisons with experiment indicate that they are probably exploring the right street. Again, the effect of the military censors seems to be noticeable.

Paper X, by Fitzpatrick and Strasberg, deals with 'Hydrodynamic sources of sound'. Those who think of this subject in terms of Lighthill's quadrupoles may be surprised to find that the first three-quarters of the article contain no reference to this source of sound. And rightly, for in most underwater situations noise associated with cavitation and bubbles is far more important. Bubble oscillation and collapse are clearly discussed and the less well known phenomena associated with surface splash are described. When the authors do come to consider noise due to turbulence the discussion is admirably balanced, with proper emphasis upon the importance in practical cases of solid surfaces which are not quite rigid.

In paper XI, on 'Free-streamline theory and steady-state cavitation', Gilbarg gives us a rather conventional account of cavitation behind bluff objects, with and without sharp corners. He considers the re-entrant jet to be the only physically reasonable resolution of the cavity paradox, although there is a brief discussion of Riabouchinsky's image artifice. There is no discussion at all of the important practical problem of the super-cavitating hydrofoil.

The following paper by Plesset, on 'Physical effects in cavitation and boiling', is an interesting and well-documented account of the growth of a vapour bubble from an infinitesimal nucleus in the liquid. The effects of the inertia and thermal conductivity of the water are discussed in some detail. The important inverse effect of bubble collapse is not treated, although it receives considerable attention in the discussion following the paper.

Paper XIII by Smay, on the 'Hydrodynamics of underwater explosions', is a completely qualitative, but nevertheless informative and fairly comprehensive, account of the subject. As given the paper was extensively illustrated by motion pictures, and unfortunately the half-tone illustrations of the written paper cannot give so much information. The paper is chiefly valuable for showing the great diversity and complexity of the phenomena involved, and the reader who wants details will have to look to the bibliography.

Lin's paper 'On the stability of the laminar boundary layer', unlike most others in the volume, is not really a review but rather is an account of his most recent attempts to deal with this problem, now over half a century old. The article presupposes a good deal of background in the long history of the study of the stability of perturbations in the laminar boundary layer, and tends to

be too cryptic to be readily understood by anyone not actively working in the field. As such the article would appear more at home in a research journal than in a book of this type.

Paper XV, by Corrsin, is given the very general title 'Some current problems in turbulent shear flows'. It ranges over so much ground that no reasonable outline is possible here. This remark should not be taken as hostile criticism. Indeed, the article contains many valuable comments, some of which I have not seen in print elsewhere, and I have repeatedly recommended it to students who, with some background, want an outline of recent activity in turbulence research. It is especially useful in pointing out the limitations of such glib assumptions as local isotropy.

The volume concludes with an article on 'Wave scattering due to turbulence', by Batchelor. The paper deals entirely with sound waves; although he points out that a similar technique can be used for electromagnetic radiation. This topic has been dealt with in several places in the literature, but rather than offer a review of these contributions, the author has preferred to go about it in his own way. In this he is, I think, justified. While his presentation, based like all the others on the first Born approximation, offers no new results, it is tidier and more self-contained than its predecessors. The discussion following the paper is livelier than most. Unfortunately it died too early. One should like to have had resolved the dispute between Batchelor and Kraichnan as to whether or not the motion can be rigorously resolved into turbulence and sound waves.

It can thus be seen that this volume does serve some purpose, in that it presents reviews of subject matter not elsewhere reviewed. However, one could wish that it were as easy to persuade people to write proper survey articles—and to get them published—as it seems to be to get them to attend and address a conference. Almost without exception the articles would have been better if written for publication, rather than for presentation. It is half a loaf—but still better than no bread!

R. W. STEWART

Festschrift Jakob Ackeret. *Z. angew. Math. Phys.*, vol. IX b (Sonderband), 1958. 777 pp. SFr. 24.00.

It is an established practice to honour a great scientist with a commemorative volume presented to him on the occasion of an anniversary. As a rule, such a volume is composed of contributions of his colleagues and former students. The present volume honours Prof. Jakob Ackeret on the occasion of his sixtieth birthday. There is always a danger that original contributions included in such a separate volume may be 'lost' to the scientific world through poor distribution. This danger is here circumvented in the best possible way, through publication as a special issue of a scientific journal of high repute.

The Festschrift Jakob Ackeret contains first some half-dozen articles on Prof. Ackeret and the relations between his work and other groups. There is also a bibliography which includes 108 original publications of Prof. Ackeret as well as various publications of his colleagues. Discussed in this first section of the

Festschrift are his contributions to the Swiss machine industry, national defence, munitions industry, and to the development of closed-cycle gas turbines.

The main part of the Festschrift comprises 58 contributed articles, with a foreword by von Kármán. As is appropriate in a collection dedicated to Prof. Ackeret, almost all the articles are in the field of fluid mechanics or in closely related fields. There are about a dozen papers in the fields of cascade theory and turbine design, another dozen on boundary layers, and another dozen in theoretical gasdynamics. The fields of low-speed flow and of aerodynamic testing techniques each occupy about half a dozen papers.

Any fluid mechanician should find material of interest in this thick volume. As a sample of the contents here are some titles which were of particular interest to the reviewer:

BRUHN, G. and HAACK, W.: Ein Charakteristikenverfahren für dreidimensionale instationäre Gasströmungen.

BUSEMANN, A.: Aus- und Eintrittsstösse an Schaufelgittern.

MEYER, R. E.: On the structure of supersonic flow.

PAULI, W.: Zur Thermodynamik dissoziierter Gleichgewichtsgemische in äusseren Kraftfeldern.

RESLER jr., E. L. and SEARS, W. R.: Magneto-gasdynamical channel flow.

ZIEGLER, H.: An attempt to generalize Onsager's Principle, and its significance for rheological problems.

This list is purely illustrative and in no way intended as a selection of the most important articles. A different reviewer might have chosen a completely different list. The articles are all of publishable quality and the general level is high.

WALLACE D. HAYES