

inhomogeneous medium. This last section however seems to be out of place since the discussion emphasizes methods typically used in underwater acoustics. The examples presented in Figures 4.23 and 4.24 are for sound propagation over 100 km in 5000 m of water. Some examples of how these methods are applied in air would be preferable since they would help identify the requirement of this type of modelling in airborne acoustics.

Chapters 5–8 are the most valuable parts of this book. The first of these describes analytic expansions and approximation procedures used in acoustics, including a clear explanation of the method of stationary phase and the method of steepest descent. This is followed by a description of the Kirchhoff approximation, Neumann series and the WKB method. Rays and the geometrical theory of diffraction are then described, followed by a section on the parabolic equation approximation. Finally, a brief introduction is given to the Wiener Hopf method. Chapter 6 provides a useful description of the numerical techniques required for boundary integral methods. It includes descriptions of Galerkin and collocation methods. Although the shortest chapter, this may prove to be one of the more useful contributions of the text. Chapter 7 gives a reasonably complete description of sound propagation in ducts, including infinite ducts of rectangular and circular cross-section, and the Pekeris solution for sound propagation in a range-dependent shallow water channel.

Chapter 8 deals with sound radiation and transmission by thin plates. The one-dimensional example given in section 8.1 provides a clear description of the important physical effects which occur in structural acoustics. The discussion is then extended to two-dimensional plates which support flexural waves with light fluid loading, baffled plates and finally a brief description is given of a plate excited by a turbulent boundary layer.

This book is designed for graduate students and researchers with advanced skills in mathematics. It provides a summary of the mathematical techniques currently used in linear acoustics. The approach is more up to date than in many other texts and so this book will be useful for those who apply theoretical and numerical methods to acoustic propagation and radiation problems. Care must be taken when reading the book to keep track of the notation. There are many inconsistencies between chapters especially in definition of variables describing density, pressure and distance. Each section is self-consistent but cross-referencing equations between sections can be confusing. At times the book appears to be repetitive when read from cover to cover, but the main use of this text will undoubtedly be as a reference and so it may be an advantage to have similar material presented from different perspectives for each application. In general, this book will be useful to students of theoretical acoustics, and researchers interested in boundary element methods and sound radiation from vibrating structures.

S. A. L. GLEGG

doi:10.1006/jsvi.2000.3046, available online at <http://www.idealibrary.com> on 

IN FASCINATION OF FLUID DYNAMICS. A SYMPOSIUM IN HONOUR OF LEEN VAN WIJNGAARDEN, 1998, A. Biesheuvel and G. F. van Heijst, editors. Dordrecht: Kluwer Academic Publishers. x + 502pp. Price NLG 395.00, USD 214.00, £135.00. ISBN 0792350782

This volume is part of the series “Fluid mechanics and its applications”, published by Kluwer Academic. The contents are reprinted from Applied Scientific Research Vol. 58

(1–4) (1997/98). With contributions from outstanding researchers in the field of fluid dynamics, this book celebrates nearly 30 years of distinguished teaching and research undertaken at the University of Twente by Professor Leendert van Wijngaarden. It is based on a symposium held within a week of his retirement and his 65th birthday. The topics covered reflect, in over 20 papers, the wide research interests of Professor van Wijngaarden.

The text opens with the unabridged text of the speech, given by Professor Zandbergen at Twente, to mark Professor van Wijngaarden's retirement. This charming piece records not only an exceptional career, but also provides a personal perspective afforded by the crossing and re-crossing of the paths of both writer and subject. At that time, the speech was illustrated with a wealth of photographs, spanning the life of Professor van Wijngaarden. It is a credit to the vividness of the imagery that the ability to reproduce only four of these photographs within the article detracts only slightly from the enjoyment of its reading.

Following this, and complementing it, is an article by Professor Prosperetti which records the scientific work achieved by Professor van Wijngaarden prior to his retirement. Whilst multiphase flow is given the greatest coverage, Prosperetti's structured approach ensures the reader not only appreciates the breadth of the research, but the clarity of the writing communicates a wealth of scientific understanding. This is a considerable achievement. Prosperetti subdivides the article into five topic areas (pressure waves in bubbly liquids, bubble dynamics, two-phase flows, standing waves in resonant systems, and flow cavitation noise). He then concentrates attention on a selected number of papers from the full list of Professor van Wijngaarden's publications (which can be found in an Appendix to the article). Prosperetti has chosen his topics well, explained them expertly, and places them in a historical context that not only provides an illuminating perspective on a distinguished career, but is also an excellent education on the development and testing of ideas.

The subject matter of this volume lends itself, at times, to attractive and informative results from photography. Particularly, stunning examples can be found in papers on jet formation during collapse cavitation (see below), and on the formation of droplets and other features by unsteady liquid jets in a gas atmosphere (Meier *et al.*). It is perhaps surprising that the opportunity to show such images in a commemorative volume such as this was not taken by more authors.

Editing is skillfully done, although the style is not completely uniform (for example, although the book is produced with numerical reference lists at the end of each article, some authors clearly presented the editors with alphabetic lists). The involvement of so many authors has in all other respects been carefully handled by the editors, who have used it to provide the reader with stimulating juxtapositions of style and content. For example, after a review by Moreau of 30 years of turbulence in magnetohydrodynamics research, with the emphasis on experimentation, we are presented with a study combining experiment and numerical simulation of the self-organization into counter-rotating cells of decaying two-dimensional turbulent flows in a finite rectangular domain (van Heijst and Clercx). Elsewhere, the reader can progress from the design of ship propellers (Kuiper), via the shape of three-dimensional cavities in supercavitating flows (Tulin), to the unsteady behaviour of a sheet cavity on a hydrofoil (de Lange and de Bruin). Another sequence of papers discusses aspects of fluidized beds, including the formation of particle-free regions (Homsy), the stability of a sedimenting gas fluidized bed (Valiveti and Koch), and the measurement of the pressures resulting from particle-wall and particle-particle collisions, as found in liquid-fluidized beds and in liquid-solid flows (Zenit, Hunt and Brennen).

A particularly good example is to be found close to the opening of the book, with two papers on cavitation bubbles, with emphasis on their collapse and the formation of jets. Lauterborn and Ohl present an accomplished review of experimental work, with emphasis

on high-speed photography and the insights which such results afford. In addition to jet formation and luminescence, attention is paid to shock wave emission. The observation of multiple shocks from a single collapse leads to a discussion of how this could be responsible for the formation of a counterjet. Explanations are also proposed for the dancing motion of bubbles close to pressure antinodes. The tensor of the piece is based on insightful interpretations of photographic (and pressure) data. The article that follows it, by Blake *et al.*, also interprets high-speed photographic data, but it is weighted towards modelling the jet formation and impact as the bubble collapses close to a rigid surface. The comparison of theory with experiment for surface shapes, velocities and pressures is informative and enlightening, drawing attention to features beside the jet, such as the pressures generated on a ring around the bubble by a “splashing” mechanism.

An excellent and innovative paper by Professor Lighthill extrapolates the predictions of a probabilistic model to estimate the ocean spray distribution at extreme wind speeds. This is important because of the cooling this spray can introduce into the thermodynamics of Tropical Cyclones. Detailed observations are only available for windspeeds of around half those found at the eyewalls of such cyclones. As the author indicates, space requirements result in only a brief description of the ocean spray model, no details on the thermodynamics of Tropical Cyclones, and the impression that there is far more to be gained from discussion of the results than space allows. However, this is a tantalizing paper which directs the reader to references where such issues can be explored.

Prior to the final paper in the book, a set of six papers examines characteristics of bubble populations as they rise or interact with flow or turbulence. The volume closes with an insightful perspective from Professor Hunt on the contribution which fluid dynamics has to make in assisting qualitative questions to be posed and addressed with clarity and precision. This is a rare and lucid example of the consideration which, in a research environment, is all too difficult to find time to make.

Two things are very clear from this volume. The first is that the contribution to the field by Professor van Wijngaarden has been outstanding and inspirational. This is evident throughout the volume, both explicitly in the personal comments of the contributors, and implicitly, in the frequent reference made to his works and ideas by authors when describing their own research. His retirement has been well commemorated by this volume. The second is the conviction that the field has the momentum, the wealth of application and fundamental questions, and the outstanding body of dedicated researchers of international repute, to ensure it has a distinguished future.

T. G. LEIGHTON