

## REVIEWS

**Hydraulics and Hydraulic Research: A Historical Review. International Association for Hydraulic Research 1935–1985.** Edited by GUENTHER GARBRECHT. Balkema, 1987, pp. 362. Dfl 165.00 or £50.00 (Dfl. 135.00 or £40.00 for IAHR members).

In September 1935 a group of distinguished hydraulicians – most of them directors of hydraulic laboratories – founded the International Association for Hydraulic Research (IAHR–AIRH) (originally named the International Association for Hydraulic Structures Research with its scope broadening in 1948 by omitting the word ‘structures’ from its name). Some well-known engineers and scientists, members of IAHR, gathered in April 1985 in Berlin to celebrate the jubilee by a Symposium on Hydraulics and Hydraulic Research – Historical Development and Present Trends preceded by a Workshop in Berlin, Braunschweig and Karlsruhe on ‘Great Names in Hydraulics’. The book under review contains in more or less chronological order contributions from both the ‘Workshop’ and the Symposium. The result is an interesting, informative and well-researched guide through 5000 years of the history of hydraulics ending with an outlook towards the year 2000; the different format of the two jubilee events is apparent, however, in the length, depth and presentation of the 33 individual papers gathered in this volume. Only some of the major contributions are briefly commented upon here.

Professor G. Garbrecht, the editor of the book, opens the text with his well-researched and illustrated contribution on ‘Hydrology and hydraulic concepts in antiquity’ starting from about 3000 B.C. up to and including Roman times. This is followed by a more detailed treatment of hydraulics in the Roman period (as known from books by Vitruvius and Frontinus) written by H. Fahlbusch.

Enzo O. Macagno, who years ago identified, classified and evaluated the fluid mechanics drawings of Leonardo da Vinci and more recently recreated Leonardo’s work in the laboratory in order to elucidate some of his more obscure passages and cryptic drawings, wrote a most interesting paper on ‘Leonardo da Vinci: engineer and scientist’, which contains a wealth of new personal interpretations of his work.

The evolution of hydraulics during the entire Italian Renaissance from before da Vinci to beyond Galileo Galilei spanning a period of 200 years from the 15th to the 17th century is presented by C. Fasso. The paper contains well-executed diagrams of flumes from that period. After some briefer contributions about Simon Reiffenstuel and Evangelista Toricelli, C. Thirriot reviews the scene in 17th and 18th century Europe, discussing in two papers (with emphasis on France in the first) the contributions of many famous mathematicians associated with the advent of hydrodynamics and of engineers and scientists who made a lasting contribution to the experimental hydraulics of the 18th century. Briefer contributions deal individually with the work of Poleni, Bernoulli, Euler and Gerstner.

‘Advances in hydraulics and fluid mechanics in the 19th century’ are discussed in a paper by M. Kenn. The text contains reproductions of delightful drawings illustrating some of Froude’s instrumentation as well as a photograph of Parson’s 1895 cavitation tunnel.

The next four papers are devoted to river hydraulics: ‘Manning and Mulvaney (– river improvement in 19th century Ireland’ (J. C. I. Dooge), ‘Fluvial hydraulics throughout history’ (H. Scheuerlein), ‘River training works throughout the history

of China' (L. Ruiju, Z. Zhaojin, H. Jialin) and 'Historical development of concepts in open channel flow' (J. C. I. Dooge). The two last papers are particularly interesting both for their breadth as well as the depth of coverage of their respective subjects, with an excellent bibliography attached to the last paper.

Three authors (Starosolszky, Kolar and Hancu) provide brief biographical notes on some notable hydraulicians in some of the Danubian countries and a relatively short text by M. F. Skladnev, L. A. Zolotov and A. M. Proudovsky surveys 'The development of hydraulic investigations in the USSR'.

The next papers deal with hydraulic machinery, starting with a survey of 'Great names and the development of hydraulic machinery' (J. Raabe) (with an interesting discussion of the impetus of hydraulic machinery on human history), continuing with a paper on 'Present trends in hydraulic development and application of hydraulic machinery, especially in hydroelectric stations' (O. Eichler). This is followed by biographical notes on F. Prasil, K. Pressel, J. Weisbach, H. Engels, T. Rehbock, W. Fellenius and L. Prandtl and their contribution to hydraulics and hydraulic research.

Hunter Rouse, the doyen of the history of hydraulics, writes about 'Five international Americans' (J. R. Freeman, B. A. Bakhmeteff, L. G. Straub, R. T. Knapp and A. T. Ippen) and about 'Hydraulics' latest golden age' – a personal rendering of Rouse's encounter with many hydraulicians, starting from his activities as the second holder of an MIT fellowship established under the influence of Freeman, and finishing with his visit to Karlsruhe in the seventies. Fittingly the last of the contributions dealing with personalities is a tribute by J. F. Kennedy and Enzo O. Macagno to 'Hunter Rouse, hydraulician'.

The paper on 'Simulation of hydraulic phenomena in the 20th century' by three research workers from the Delft Hydraulics Laboratory (Vreugdenhil, Kolkman and Abraham) reviews briefly the role and development of scale, analogue and mathematical models during the last 50 years – the lifespan of IAHR. The papers '50 years of the IAHR' and 'IAHR, what will it be?' by H. J. Schoemaker and J. E. Prins, the immediate past and present secretaries of IAHR, summarize the history of the Association and attempt to look ahead to its role within the family of non-governmental organizations.

The book concludes with J. F. Kennedy's chapter 'Hydraulic trends towards the year 2000', confronting the present scene with that envisaged by a group of experts in 1977 and attempting an extrapolation towards the end of the century.

A number of papers dealing with certain personalities and periods in the development of hydraulics have been written during the last thirty years, but this is the first time since the publication of the classic *History of Hydraulics* by H. Rouse and S. Ince in 1957 that it has been done in book form and with such a wide span. Although the parting of the ways of experimental hydraulics and classical and applied hydrodynamics in the 18th and 19th centuries, followed by their renewed alliance in the 20th century seems to be more apparent in Rouse's book, in certain areas the IAHR Jubilee volume contains a great deal more detail, some of it hitherto unpublished. With the exception of a few contributions (the most notable amongst them the paper on development of concepts in open-channel flow by Dooge) the authors deal with issues and concepts in hydraulics against the background of the description of contributions by personalities rather than the other way round; nevertheless researchers into the development of ideas in hydraulics will find the volume indispensable. The book as a whole is a fitting tribute to the fiftieth anniversary of an organization that is at the forefront of promoting hydraulic

research today. It is also a book that should be in the reference section of libraries and on the shelves of those seriously interested in the history of hydraulics and fluid mechanics.

P. NOVAK

**Recent Advances in Planetary Meteorology.** Edited by GARRY E. HUNT.  
Cambridge University Press, 1985. 161 pp. £20.00.

From the reader's point of view the emphasis should be put on 'recent advances'. This is not a source book for basic information about the planets. Indeed the reader is advised to start with the final chapter which clearly describes the differences between the atmospheres of Venus, Earth, Mars, Jupiter and Saturn. In spite of its very slow rotation Venus has some strong zonal winds; Mars undergoes total atmospheric mass changes of up to 30% because of deposition of CO<sub>2</sub> around the winter pole and has dust storms which occasionally, but not every year, engulf the whole planet with a major switch of solar heating from the ground to the dust. Jupiter, whose outer visible appearance shows the dominance of rapid rotation and zonal flow with eddies in bands at the 'surface', has not yet yielded the secret of its atmosphere's depth. Saturn, like Jupiter, has an internal heat source of important magnitude. This last chapter falls short of Uranus, whose axis of rotation lies in the plane of the ecliptic with interesting seasonal effects, no doubt.

The dominance of photochemistry in the deep and dense atmospheres of Venus, Jupiter, Saturn and probably Uranus is emphasized in the first two, substantial, chapters. Mars is the subject of the next two, emphasizing the importance of dust (which could mean that the whole surface of the planet may be mineralogically sampled at very few points).

The dynamics of Jupiter and Saturn have been fairly extensively modelled although the interior motion is still mostly unknown. After a brief chapter on this, the penultimate chapter embarks on the most speculative topics of all those discussed, with ideas with which most meteorologists will be least familiar – energy changes involving gases containing silicon or magnesium. On the large geometric scale of the internal eddies such energy releases may be important producers of buoyancy variations. It is suggested that conversion between the ortho and para states of molecular hydrogen would also be a significant cause of buoyancy changes. With these we have come a long way qualitatively from the Earth's atmosphere. All the planets present challenging problems of large detail – Venus's zonal winds and gravity waves, Mars's dust, Jupiter's Great Red Spot, Uranus's 90° inclination – and frightening complexity, both dynamical and chemical.

I am not competent to advise the expert in this field, but other readers will probably need to approach each chapter several times before grasping all it has to say. On the other hand the chapters cover such a variety of topics that even random browsing can be stimulating and rewarding. A significant criticism is that the writers seem to have had neither need nor obligation to write for others than themselves or their immediate colleagues, and the book assumes a considerable previous understanding on the part of the reader, both of known facts and of the nature of the unsolved problems.

This unglamorous book has no pictorial pretensions. The pictures of martian dust storms are of very poor quality indeed, and the polar stereographic projection of Jupiter's southern hemisphere is a mere 5 cm square, and poor at that. It is a great pity that the reader's imagination has not been fed with any of the excellent pictures

now available. I am sure that many must have been shown at the 1983 symposium from which the papers are drawn. That symposium was held in memory of Seymour Hess who died in January 1982 and was first president of the Commission on Planetary Atmospheres and their Evolution, from 1977. The volume may have significant influence on the kind of observations to be made in the next round of planetary exploration.

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