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REVIEWS

Ähnlichkeitsgesetze und Modellregeln der Strömungslehre. By J. ZIEREP. G. Braun, 1972. 138 pp. DM 16.40.

Similarity Laws and Modeling. By J. ZIEREP. Marcel Dekker, 1972. 157 pp. $14.50.

The German original is a paper-backed pocket-book neatly reproduced from a typescript with clear hand-written equations. This is a form of reproduction which we are likely to meet more and more frequently as the price of conventional printed books continues to rise. This is an excellent example of the standard that can be achieved by careful but inexpensive techniques.

The author sets out to present a unified survey of all the ideas which have been described by the general term 'similarity' in fluid mechanics. The underlying principle is really to look for all possible means of reducing the number of parameters and variables involved and thus to reduce the theoretical, computational and experimental work. He therefore includes not only the concepts of dynamical similarity of geometrically similar systems but also the similarity laws of gasdynamics which compare flows which may be obtained by means of affine transformations. Although both approaches lead to a reduction of labour one wonders when reading the book how much they really have in common.

In a brief historical introduction the reader is introduced to the dynamical similarity parameters linked with the names of Reynolds, Froude, Mach, Euler, Knudsen, Weber and Strouhal and the gasdynamical similarity laws of Prandtl, Glauert, Guderley, von Kármán, Oswatitsch and Tsien. The significance of the dynamical parameters is illustrated by a number of simple examples.

In the next chapter the laws of dynamical similarity are discussed rigorously starting from the Π-theorem and moving through a discussion of the significance of the non-dimensional parameters as ratios of forces, accelerations and energies to the use of similarity concepts in the formulation and simplification of the flow differential equations, exemplified by the boundary-layer equations. Similarity by transformation of variables is treated as a separate topic and illustrated by the impulsively started plate, the decay of a vortex and the Prandtl–Meyer expansion.

The third chapter is devoted to the similarity laws of classical inviscid gasdynamics dealing in turn with linearized subsonic and supersonic flows, and transonic and hypersonic flows. Most students would probably find this chapter rather difficult to follow in detail without extensive background reading.

Although the two types of similarity are brought together in the introduction they are thus given separate treatment in the two main chapters of the book.

The final brief chapter deals with some aspects of similarity in non-equilibrium flows, stressing the importance of the time and length scales resulting from the final rate of approach to equilibrium. It is noticeable that apart from a brief note on shock-wave stand-off distance the discussion is limited to linearized solutions for small departures from equilibrium. This seems a pity as departures from equilibrium are often large and nonlinear.

The book is on the whole interesting and readable. As it contains very little new material, it is obviously intended as a textbook. Students with some background in fluid mechanics who have already met examples of the two types of similarity might well be inspired by the large number of examples to look for similarity in other fields.

The English version is a neat hard-back reproduction from typescript, and appears as volume 2 of the series on "Gasdynamics" edited by Professor Wegener. Volume 1 of this series appeared in two parts under the general title of "Non-equilibrium Flows" and contained eight textbook-type articles of high standard. The editor's justification for the inclusion of Professor Zierep's text in the series is that it will prepare the ground for the future volumes in the series dealing with experimental techniques. This seems a sound enough argument and an English version should therefore fit in well with the general scheme.

It is unfortunately necessary to express some slight reservations about the English edition. An already difficult subject has been made even more difficult by a lack of clarity in the translation, ranging from the cumbersome and quaint to a few cases where the original meaning gets completely obscured.

N. H. JOHANNESEN

Annual Review of Fluid Mechanics, Volume 4. Edited by M. VAN DYKE, W. G. VINCENTI and J. V. WEHAUSEN. Annual Reviews, Inc. 1972. 504 pp. $10.

The fourth volume in this successful series is now available. The contents are as follows.

As luck would have it – a few mathematical reflections, H. Villat.

Fluid mechanics of heat disposal from power generation, D. R. F. Harleman & K. D. Stolzenbach.

Mantle convection and the new global tectonics, D. L. Turcotte & E. R. Oxburgh.

Finite amplitude disturbances in the flow of inviscid rotating and stratified fluids over obstacles, R. R. Long.

Locomotion of Protozoa, T. L. Jahn & J. J. Votta.

Magnetohydrodynamics of the earth's core, P. H. Roberts & A. M. Soward.

Chemically reacting flows, E. Becker.

Vortex breakdown, M. G. Hall.

Self-gravitating gaseous disks, C. Hunter.

Cavity and wake flows, Th. Y.-T. Wu.

Self-similar solutions as intermediate asymptotics, G. I. Barenblatt & Ya. B. Zel'dovich.

Periodic flow phenomena, E. Berger & R. Wille.

Oil spreading on the sea, D. P. Hoult.

One-dimensional flow of liquids containing small gas bubbles, L. van Wijngaarden.

Sailing vessels and sails, J. H. Milgram.

Wing–body aerodynamic interaction, H. Ashley & W. P. Rodden.

Bounds of flow quantities, L. N. Howard.

It can be seen that the topics considered cover a very wide range of fluid mechanics and most of the papers make interesting reading.

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