

Preface to the online edition of ‘Surface Waves’

Since its first publication in 1960, the article *Surface Waves* by John V. Wehausen and Edmund V. Laitone has been an inspirational resource for students and research workers in the various fields of science and engineering where water waves are important. This reference has been cited frequently in the literature of these fields, and even after the passage of nearly half a century it continues to serve a unique role. This may be attributed to its encyclopedic scope and to the scholarly efforts of the authors.

Surface Waves was originally published in Volume IX of the *Encyclopedia of Physics*, together with five somewhat shorter articles on other branches of fluid mechanics (by M. Schiffer, H. Cabannes, R. E. Meyer, R. Timman, and D. Gilbarg). This volume has been available mainly through university libraries, with limited distribution to individuals. It has been out of print for many years.

The importance of *Surface Waves* was anticipated in a review written by Professor F. Ursell for *Mathematical Reviews* (Review 10417, Volume 22, No. 10B, 1961, pp 1776-7). The following paragraphs are quoted from Ursell’s review:

Wehausen’s contribution is a review article, and a most valuable and thorough one. Can it be that Wehausen has read critically all the 700 works listed in the bibliography? From sample tests the reviewer is inclined to think that he has. It is impossible to give more than a brief discussion of the contents. Chapter A outlines the scope of the work. Chapter B gives the exact equations and boundary conditions for viscous and inviscid fluids. Chapter C discusses with care the schemes of approximation leading to the classical infinitesimal-wave and shallow-water theories, and also contains certain exact considerations on wave velocity, momentum, and energy. Chapter D, which forms the greater part of the review, is devoted almost entirely to the potential theory of infinitesimal waves. The velocity potential $\phi(x, y, z, t)$ satisfies Laplace’s equation with simple linear boundary conditions. The general theory of this system is not yet understood. Thus for the important case of time-periodic motion the general uniqueness problem is still unsolved, and only a few partial results are known. A picture of surface-wave behaviour is, however, beginning to emerge from the solutions of a variety of boundary-value problems which are described in the review. Chapter F describes the known theory relating to the exact nonlinear equation, a part of the subject which will be less familiar to readers than the theory of infinitesimal waves.

Among omissions (probably due to lack of space) is the comparison with experiments which have shown that much of the theoretical work on inviscid fluids is directly applicable to real fluids. It has also been noted that several sections contain no reference to any other author and are presumably due to Wehausen himself. One of the most noteworthy is section 15 on group velocity and the propagation of disturbances and of energy. That energy propagates with the group velocity has appeared to many students as an unexpected coincidence. It will appear less so after Wehausen’s discussion.

Wehausen deserves to be congratulated on a scholarly and well-written review. We now turn briefly to Chapter E on shallow-water waves, by Laitone. This author has preferred to concentrate on a few aspects rather than to give a survey of all that is known. (Particularly on some non-linear aspects our knowledge at present is slight.) The treatment is thorough and interesting.

To sum up, this article on surface waves is a most worthy contribution to the *Encyclopedia of Physics* which many workers in fluid mechanics would be glad to possess. Unfortunately the price of the complete volume is too high for a wide distribution. The publishers would perform a service by separate publication of this article, perhaps after a lapse of some time.

After a lapse of some forty years, Ursell’s review seems prophetic. We have all been impressed by the quality and importance of *Surface Waves*, which has provided concise and authoritative references for much of our own work. To facilitate its use by the generations

that are following us, we have developed a digitally scanned edition suitable for distribution online. We first proposed this concept to Professor Wehausen, and received his approval. He took the vital step of obtaining the electronic rights of the article from the original publisher Springer Verlag, which has also approved the the establishment of the online site. The essential principle, which we share with Professor Wehausen, is that the Online Edition of *Surface Waves* should be freely available to all interested persons, throughout the world. Individuals may download part or all of the article, redistribute it in digital format, and print hardcopies for personal or academic use. The electronic rights of the article *Surface Waves* have been assigned by Professor Wehausen and the Estate of Professor Laitone to the Regents of the University of California. Unauthorized commercialization of current and future online versions is strictly prohibited. The Committee on Surface Waves will continue to have editorial rights of the online article.

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