

Preface

“There is no subject so old that something new
cannot be said about it.”

F. Dostoevsky

This book is the written and somewhat expanded version of the author’s lectures delivered at the NSF-CBMS international research conference organized at the Mathematics Department of The University of Texas-Pan American, Edinburg, Texas, USA, during the week May 17–21, 2010. The aim of the conference was to provide an overview of some of the main results and recent developments in nonlinear water waves. Accordingly, these lecture notes represent, in part, a survey of fundamental aspects of the field and, in part, a discussion of several important topics of current research interest. The material presented contains a selection of aspects of water-wave motion that is believed to be of intrinsic mathematical interest and of physical relevance, and where a mathematical study can be pursued to an advanced stage, enabling us to derive conclusions that explain, to some extent, observed phenomena. The mathematical considerations are preceded by a discussion of the underlying physical factors, and we discuss the physical relevance of the mathematical results that are presented. No attempt is made to cover, in any complete sense, all the important topics of water-wave theory; indeed, we do not even exhaust the topics discussed here! The material described in these lectures is not intended, in any sense, to provide a systematic treatise of the theory of water waves. The exposition aims more at conveying a feel for the scope and usage of the main ideas and techniques than at proving all the relevant theorems in detail. However, many important results are proved in full, while for others the proofs are merely sketched, in which case we strive to provide either sufficient background to enable the details to be completed without difficulty, or appropriate references. In an effort to make the book accessible to a wide audience we do not aim for the most general formulation, thus avoiding an excess of pure technicalities, nor do we have any qualms in attempting, occasionally, to present a lot of details, even at the risk of boring those able to proceed faster—such readers may indulge in judicious skipping. We hope that mathematicians, physicists, and engineers will find that the interplay between physical concepts/insights and mathematical ideas/methods provides a convincing description/explanation of some specific water-wave phenomena encountered in nature. We also believe that the reader without

advanced expertise in mathematics/physics will be able to find some passages of interest: we have tried to present mathematical results in conjunction with physical interpretations, in order to provide some acquaintance with the subject.

I am very grateful to Professor Lokenath Debnath, the chair for this particular NSF-CBMS conference, for inviting me to be the principal speaker and for his efforts to assemble a successful NSF-CBMS application. Many thanks to the faculty and staff members of the Department of Mathematics at The University of Texas-Pan American for their gracious and warm hospitality, offering a perfect environment for scientific interaction and making the stay so enjoyable for all the participants. I also wish to thank all of the participants for providing stimulating discussions and contributing talks, keeping the lectures and workshop sessions so lively. I am grateful to the National Science Foundation (USA) for its generous support and to SIAM for publishing this book.

Throughout my activities related to the study of water waves I was fortunate to benefit from many conversations and collaborations with a number of researchers, profiting a lot from their generous sharing of ideas, insights and enthusiasm, as well as from their support and encouragement. I am especially indebted to Professor Joachim Escher, Professor Robin S. Johnson, and Professor Walter A. Strauss. I also wish to thank them for their advanced lectures on the occasion of this CBMS conference. Professor Joachim Escher, Professor David Lannes, Professor Walter A. Strauss, Dr. Mats Ehrnström, Mrs. Anna Geyer, Dr. David Henry, Dr. Boris Kolev, Mr. Raphael Stuhlmeier, Dr. Eugen Varvaruca, and Dr. Erik Wahlèn read portions of the draft manuscript. I have greatly profited from their comments. This book would have been far less than it now is without the invaluable service rendered by the thoughtful suggestions of Professor Robin S. Johnson on large parts of the manuscript. I am also indebted to several copyright owners for permission to reprint photographs and figures. The author would also like to thank Ann Manning Allen, Sara J. Murphy, Gina M. Rinelli, and Ronald C. Rosier for their help with the production of the book.

I cannot express adequately how much pleasure I have gained from consulting various publications (research/survey papers as well as lecture notes and books) related to these notes. Throughout the text I have tried to refer to these texts as an acknowledgement of their inspirational role but also as an indication of possible further reading. Nevertheless it is likely that I neglected to mention many other sources from which I have profited; if so, I sincerely apologize.

Adrian Constantin

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