Preface to the Third Edition

As the title tells, the book deals with random sea waves on their statistical nature and interaction with maritime structures. Why do we need to introduce the random nature of sea waves into engineering practice? It is because the randomness is the fundamental characteristics of sea waves and its neglect leads to gross errors in engineering assessment. The concept of random seas has already been accepted by the majority of coastal engineers and researchers. The International Standards ISO 21650 *Actions from Waves and Currents on Coastal Structures* issued in 2007 adopts the wave spectrum and statistics as the fundamental tool for assessing wave actions. The Proceedings of the 5th International Conference on Coastal Structures in 2007 and the 31st International Conference on Coastal Engineering in 2008 contain many papers employing random waves in theory, laboratory tests, and engineering applications.

This is the third edition of the book first published in 1985 by University of Tokyo Press. The second edition was published in 2000 by World Scientific as one of *Advanced Series on Ocean Engineering*. The book has been evolved from its Japanese edition in 1977 published by the Kajima Institute Publishing Company, which was subsequently revised in 1990 and 2007. The book has been enlarged through successive revisal works.

The book is composed of four parts. Part I is for practicing engineers by providing design tools to deal with random seas. Part II is for graduate students to serve as a textbook of random wave theory. Part III deals with the methodology of extreme wave analysis for selection of design wave height. Part IV is a new addition to the present edition, which overviews beach morphological problems from the viewpoint of coastal managers and field engineers who are rather unacquainted with research works. It emphasizes a historical view of a coast under study and the necessity of field

validation data whenever one tries to make prediction of future morphological changes.

The content of the book has been enlarged quite much. In addition to Part IV, two chapters are newly added on the topics of the probabilistic design of breakwaters and the 2-D computation of wave transformation with random breaking and nearshore currents. The total pages increased from 443 in the second edition to 708 in the present edition. The number of references including duplication increased from 316 to 718. Forty new figures and fourteen new tables were introduced.

One feature of the book is inclusion of the information available only in Japanese. Among 718 references, 150 papers were written in Japanese. They are referred to in various chapters of the book but appear mainly in Chapters 3 to 7 that deals with wave actions on structures. I believe that the Japanese experience and technology would make good contribution to the progress of coastal engineering in the world.

Nowadays a great many number of research works and field reports are presented in various conferences and technical journals. It is almost impossible for any one to make appropriate review of all recent accomplishments. I have picked up papers that attracted my attention rather subjectively and tried to convey what is useful for practitioners and future researchers. If I failed in referring to important accomplishments, I must request the kindness of the readers for pardoning my failure.

Similarly as the previous editions, many colleagues and friends helped me greatly by providing me with valuable information and data. From the Port and Airport Research Institute, Dr. Ken-ichiro Shimosako gave advices on the expected sliding distance of caisson breakwaters, Dr. Katsuya Hiramaya clarified my questions on the Boussinesq equation, Dr. Takeshi Nagao gave a lecture on reliability design method, and Dr. Tetsuya Hiraishi and Dr. Yoshiaki Kuriyama provided me with many references related to the subjects in the present book. Mr. Tadashi Tamada of IDEA Corporation kindly provided me with his data set and diagrams of wave overtopping rates of inclined seawalls, which are reproduced as Figs. 5.8 to 5.10 in Sec. 5.2.3. Prof. Kyung-Duck Suh of Seoul National University in Korea kindly sent me a meticulous corrigenda to the previous edition, which have duly been corrected.

As for Part IV, Professor Robert G. Dean, Dr. Yoshiaki Kuriyama, and Dr. Atilla Bayram kindly read the manuscript and advised me a number of corrections and revisions. Especially I am very grateful for Prof. R. G. Dean for his meticulous review of the draft and many excellent advices.

I am indebted to many more friends and express my thanks for their kind corporation extended to me.

Yoshimi GODA
Yokosuka, Japan
November 2009

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Preface to the Second Edition

This is the second edition of the book first published in 1985 by University of Tokyo Press, which was an enlarged English edition of my book in Japanese published in 1977 by the Kajima Institute Publishing Company. The Japanese edition was revised in 1990 with the addition of new material, especially of a new chapter on the statistical analysis of extreme waves. In the present edition, further revisions have been made to update the book's content.

Additions to the first English edition are the new sections on the relationships between wave statistics and spectrum, the longshore currents induced by random waves, the motions of ships at mooring, the tests with multidirectional random waves, the advanced theories of directional spectral estimates, and the new chapter on extreme wave statistics. Several sections have been thoroughly rewritten, such as those on wave grouping, sampling variability of wave parameters, and numerical simulation of random wave profiles.

The objective of this book is twofold: to provide practicing engineers with design tools to deal with random seas (Part I), and to serve as a textbook of random wave theory for graduate students (Part II). The very warm response by many readers to the first English edition seems to reflect the success in achieving the objective. Because of the limited number of printed copies of the first edition, there was quite a large demand for the publication of the second edition. With the recommendation of Professor Philip L-F Liu of Cornell University, World Scientific Publishing Company succeeded in getting the transfer of the publishing copyright from the University of Tokyo Press in 1996. The present edition has been newly typeset from old text and additional new manuscript, the work of which took some time.

The major portion of the book is based on my research work at the Port and Harbour Research Institute, Ministry of Transport, Japan, where I worked from 1957 to 1988. Many staff members of my research group there assisted me in carrying out a number of laboratory experiments and field data analysis. I am very grateful for their dedicated efforts. Many research topics were brought to me by many government engineers in charge of port construction and coastal protection. They taught me what problems in the field were in need of rational engineering solutions.

The publication of the first English edition was suggested by Dr Nicholas C Kraus, presently at the Waterways Experimental Station, US Army Corps of Engineers. He critically reviewed the first manuscript, clearing up ambiguities and correcting many idiomatic expressions. The success of the first edition owed much to him. My wife, Toshiko, patiently allowed me to spend many off-duty hours at home for study and writing of the first and second editions of this book. I would like to conclude this preface with gratitude to her.

Yoshima GODA
Yokosuka, Japan
November 1999

Preface to the First Edition

Our understanding of sea waves has grown considerably since the appearance of Minikin's celebrated book *Winds, Waves and Maritime Structures* in 1950. In particular, the random nature of sea waves has become much clearer, and sea waves are now described and analyzed by means of statistical theories. The ocean wave spectrum, for example, is presently a working tool of oceanographers and researchers in coastal and offshore engineering. However, engineering application of the random wave concept is as yet limited to a rather small number of researchers and engineers. This book appears to be the first attempt to present a systematic treatment and applications of the concept of random sea waves from the perspective of the engineer.

The original edition of this book was published in Japanese in October 1977 by Kajima Institute Publishing Company. I am pleased to say that the Japanese version was greeted with enthusiasm by a large number of coastal and harbor engineers in Japan. The present edition is a revision and translation of the Japanese edition.

The book is separated into two parts. Part I is mainly addressed to practicing engineers who are looking for immediate answers to their daily problems. This part consists of Chapters 1 to 7. Part II, consisting of Chapters 8 to 10, is directed toward researchers, engineers and graduate students who wish to learn the fundamental theory of random sea waves in order to carry out further developments in coastal and offshore engineering. It is hoped that the readership of Part II will not be limited to those who are civil engineers by training, but will also include naval architects, physical oceanographers and scientists in other disciplines who are interested in the complexity of random sea waves. It is assumed that the reader has a basic understanding of small amplitude wave theory, a description of

which can be found in most textbooks on coastal engineering and physical oceanography.

For practicing engineers, Part II may be somewhat difficult, but perseverance will be rewarded by a glimpse of the theoretical foundation upon which the engineering application of the random wave concept is constructed. However, an understanding of Part II is not necessary, because Part I is self-contained. For those who are pursuing subjects at the forefront of knowledge, in contrast, the discussions and recommendations presented in Part I may sound subjective, or even dogmatic. It should be remembered, however, that engineers often face situations in which they must design structures and produce drawings for construction with minimal background information on the site and limited reliable theoretical machinery for calculation. I have tried to provide guidelines for engineers — guidelines I believe to be the best available at present — in the hope of helping those who are tackling various problems related to sea waves. With advances in knowledge, some of the solutions and recommendations in this book will become obsolete and be replaced by new ones. But so long as this book serves for today's needs, its purpose will be judged to be fulfilled.

Major revisions made for the English edition are the rewriting of Chapter 4 on breakwaters and the addition of new material in Chapters 9 and 10, based on recent studies. Chapter 4 introduces Japan's vertical breakwaters and the procedures for their design, which are probably not well known to engineers outside Japan. The new material in Chapter 9 concerns the theory of wave grouping and the analysis of wave nonlinearity. In Chapter 10, discussions of the directional wave spectrum calculated by means of the maximum-likelihood method and a simulation technique for two-dimensional waves were added.

The material presented in this book mainly derives from research work conducted by the members of the Wave Laboratory of the Port and Harbour Research Institute, Ministry of Transport, Japan, which I headed from 1967 to 1978. I sincerely wish to acknowledge the efforts of the dedicated staff members of the Wave Laboratory in the successful accomplishment of many research projects. I am also indebted to many fellow government engineers who brought to my attention various stimulating problems of a difficult and urgent nature. Often they supported the research projects financially.

The publication of this English edition was suggested and initial arrangements were made by Dr N. C. Kraus of the Nearshore Environment Research Center, Tokyo. I am very grateful to him for the above and for his critical review of the manuscript. As the first reader of the English

edition, he helped to clarify ambiguities and to correct many idiomatic expressions. The staff members of the International Publications Department, University of Tokyo Press, were helpful and supportive throughout the publication process. Kajima Institute Publishing Company, publishers of the Japanese-language book, generously lent the illustration plates for use in this edition. I am also grateful to my wife, who patiently allowed me to spend many off-duty hours at home for study and writing of this book. Finally, I wish to acknowledge the financial support of the Ministry of Education, Science and Culture, Japan, for translation of the text.

Yoshimi GODA
Yokosuka, Japan
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