

## Basic Coastal Engineering

Describing the nature of the marine environment and the effects of man-made structures on the behaviour of the sea, this book deals with hydraulic design, the material properties of concrete and the design and specification of structures for coastal environments.

The science and technology of coastal and ocean engineering are closely related to harbour and fishery engineering, because they share a common basic knowledge. However, whereas various publications of coastal engineering, harbour engineering, and ocean engineering have described just the knowledge in their own respective fields, an interrelated and systematic presentation linking them together has yet to be attempted. This book is the first attempt to systematically combine the fields of coastal, ocean, harbour, and fishery engineering from an engineering viewpoint backed by hydrodynamics. Understanding the interaction of waves with structures and sediment, and predicting the associated responses of interest, underlie nearly every problem in coastal and ocean engineering. This is precisely the goal of this book. Although primarily intended for use as a special textbook for graduate students and senior practising engineers, it is hoped that this book will also serve as a useful reference and assist in the further development of this field. With these objectives in mind, each chapter deals with important problems to be solved in the near future. The references included in each chapter should aid students and practising engineers in further broadening their knowledge. This book is the English translation of the original Japanese version published in May, 1991, commemorating the author's retirement from Osaka University.

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"Waves in Ocean Engineering" covers the whole field of wave studies of interest to applied oceanographers and ocean engineers. It has considerable relevance to coastal engineering. The book is split into 12 sections, the first of which is devoted to the practical applications of wave studies and to the history of wave research. The rest of the book covers the measurement of waves, including remote sensing; the analysis and interpretation of wave data; estimating the properties of the extreme "Design Wave", as well as of the generality of waves for fatigue calculations; waves in finite depth, wave generation by wind and wave forecasting models; non-linear effects, and errors and uncertainties in wave data.

Laboratory physical models are a valuable tool for coastal engineers. Physical models help us to understand the complex hydrodynamic processes occurring in the nearshore zone and they provide reliable and economic engineering design solutions. This book is about the art and science of physical modeling as applied in coastal engineering. The aim of the book is to consolidate and synthesize into a single text much of the knowledge about physical modeling that has been developed worldwide. This book was written to serve as a graduate-level text for a course in physical modeling or as a reference text for engineers and researchers engaged in physical modeling and laboratory experimentation. The first three chapters serve as an introduction to similitude and physical models, covering topics such as advantages and disadvantages of physical models, systems of units, dimensional analysis, types of similitude and various hydraulic similitude criteria applicable to coastal engineering models. Practical application of similitude principles to coastal engineering studies is covered in Chapter 4 (Hydrodynamic Models), Chapter 5 (Coastal Structure Models) and Chapter 6 (Sediment Transport Models). These chapters develop the appropriate similitude criteria, discuss inherent laboratory and scale effects and overview the technical literature pertaining to these types of models. The final two chapters focus on the related subjects of laboratory wave generation (Chapter 7) and measurement and analysis techniques (Chapter 8).

This book presents observations on the phenomena of fine sediment transport and their explanations under process-related divisions such as flocculation, erosion, and deposition. The text is a compilation of the author's lecture notes from nearly four decades of teaching and guiding graduate students in civil and coastal engineering. Illustrations of fine sediment transport processes and their complexities given in the book are taken from field and laboratory-based observations by the author and his students, as well as numerous investigators. The wide-ranging composition of particles (of inorganic and organic matter), their universal presence and their complex interactions with hydraulic forces make this branch of science a difficult one to deal with in a single treatise. It is therefore essential to study fine sediment transport as an independent subject rather than cover it in no more than a single chapter as many texts on coarse sediment transport have done. Even though the entire coverage is "introductory", the twelve chapters collectively include more material than what can be reasonably dealt with in a one semester, three-credit course. The book includes an extensive description of the components of fine-grained — especially cohesive — sediment transport. It covers the development of the subject in scientific and engineering applications mainly from the 1950s to its present state. Solved examples and chapter-end exercises are also included. This text is aimed at senior civil engineering undergraduates and graduate students who, in the normal course of their study, seldom come across the subject of fine sediment transport in their curricula. Interested students should have a basic understanding of the mechanics of fluid flow and open channel hydraulics.

This book discusses selected theoretical topics of coastal hydrodynamics, including basic principles and applications in coastal oceanography and coastal engineering. It is not intended as a handbook; the emphasis is placed on presentation of a number of basic problems, rather than giving detailed instructions for their application. The bulk of the material deals with surface waves. In the author's opinion there is still a strong need for a book on wave phenomena in the coastal waters, as general textbooks on sea surface dynamics focus most of their attention on the deep ocean. This book intends to fill this need by concentrating on the phenomena typical of the coastal zone. Based on lectures given at the Institute of Hydroengineering, Polish Academy of Sciences in Gdansk, the approach throughout is a combination of the theoretical and observational. A basic knowledge of ordinary and partial differential equations, as well as the statistical and spectral analysis of time series, is assumed. The reader should also be familiar with fundamental hydrodynamic concepts. The book comprises nine chapters. Governing equations and conservation laws are treated in Chapter 1, using the variational principles. The theory of regular surface waves is covered in Chapters 2 to 4. The nonlinear effect of wave train modulation and their breaking of beaches is examined in Chapter 5. Chapters 6 and 7 focus on the statistical and spectral treatment of waves induced by wind. Current generation and circulation pattern are the subject of Chapter 8, while sea level variations are examined in Chapter 9. References for further reading are given at the end of each chapter.

The book provides a basic methodology for the formulation and numerical solution of mathematical models in coastal engineering. First, the mathematical theory of waves is considered; the coastal circulation due to various generating factors, such as tide, wind, density variation and waves; finally pollutant advective diffusion and sediment transport in the surf zone and wider coastal domain. The book contains numerous illustrative worked examples with the corresponding computer listings in BASIC. The book will enable engineering consultants, researchers, and postgraduate students in coastal engineering and oceanography to apply the sophisticated techniques used in major coastal engineering works to small scale design using microcomputers.

Combines More Than 40 Years of Expert Experience Computational modelling and simulation methods have a wide range of applications in hydraulic and coastal engineering. Computational Modelling in Hydraulic and Coastal Engineering provides an introductory but comprehensive coverage of these methods. It emphasizes the use of the finite differences method with

applications in reservoir management, closed-conduit hydraulics, free-surface channel and coastal domain flows, surface gravity waves, groundwater movement, and pollutant and sediment transport processes. It focuses on applications rather than lengthy theories or derivations of complex formulas and is supported by a wealth of hands-on numerical examples and computer codes written in MATLAB but available also in BASIC. PowerPoint presentations and learning assignment projects/quizzes, along with learning assessment rubrics, are included. A comprehensive study highlighting the infinite differences method, this book: Covers the fundamentals of flow in pressurized conduits Contains solutions for the classical Hardy Cross pipe network problem Designates the mathematical description of groundwater flow in confined and unconfined aquifers Provides numerical examples for one- and two-dimensional applications including saltwater intrusion Presents examples of transport of pollutants, sediment and air bubbles using Eulerian and Lagrangian solution methodologies Includes information on weighted residuals, the finite elements method, and the boundary integral method Computational Modelling in Hydraulic and Coastal Engineering suits senior-level undergraduates and graduate students as well as practitioners such as coastal and maritime engineers, environmental engineers, civil engineers, computer modellers, and hydro-geologists.

A review of the existing applications of geosynthetics and geosystems in hydraulic and coastal engineering, with an overview on material specifications, structural components, relevant tools during conceptual and detail design, possible applications, and execution aspects. A more detailed description is given of new or lesser-known systems and applications. Additional basic information on design methodology and geosynthetics is included to provide a basic framework of information for design purposes.

The handbook contains a comprehensive compilation of topics that are at the forefront of many of the technical advances in ocean waves, coastal, and ocean engineering. More than 110 internationally recognized authorities in the field of coastal and ocean engineering have contributed articles in their areas of expertise to this handbook. These international luminaries are from highly respected universities and renowned research and consulting organizations around the world.

Waves in Oceanic and Coastal Waters describes the observation, analysis and prediction of wind-generated waves in the open ocean, in shelf seas, and in coastal regions with islands, channels, tidal flats and inlets, estuaries, fjords and lagoons. Most of this richly illustrated book is devoted to the physical aspects of waves. After introducing observation techniques for waves, both at sea and from space, the book defines the parameters that characterise waves. Using basic statistical and physical concepts, the author discusses the prediction of waves in oceanic and coastal waters, first in terms of generalised observations, and then in terms of the more theoretical framework of the spectral energy balance. He gives the results of established theories and also the direction in which research is developing. The book ends with a description of SWAN (Simulating Waves Nearshore), the preferred computer model of the engineering community for predicting waves in coastal waters.

Intended for coastal engineers and marine scientists who desire to develop a fundamental physical understanding of ocean waves and be able to apply this knowledge to ocean and coastal analysis and design. Provides an introduction to the physical processes of ocean wave mechanics, an understanding of the basic techniques for wave analysis, techniques for practical calculation and prediction of waves and applied wave forecasting.

Accompanying CD-ROM in pocket at the back of book

This book is intended as an introductory textbook for graduate students and as a reference book for engineers and scientists working in the field of coastal engineering. As such it gives a description of the theories for wave and nearshore hydrodynamics. It is meant to de-mystify the topics and hence starts at a fairly basic level. It requires knowledge of fluid mechanics equivalent to a first year graduate level. At the end of each topic, an attempt is made to give an overview of the present stage of the scientific development in that area with numerous references for further studies.

This book is based on the author's 34 years of experience as a teacher/researcher of coastal engineering and management and on recent reflections on newly relevant issues, such as consequences of failure, impacts of rising sea levels, aging infrastructure, real estate development, and contemporary decision making, design and education. This textbook for undergraduate students, postgraduate students and practicing engineers covers waves, structures, sediment movement, coastal management, and contemporary coastal design and decision making, presenting both basic principles and engineering solutions. It discusses the traditional methods of analysis and synthesis (design), but also contemporary design taking into account environmental impacts, consequences of failure, and current concerns such as global warming, aging infrastructure, working with stakeholder groups, regulators, etc. This second edition expands greatly on the topics of failure and resilience that surfaced as a result of recent disasters from hurricane surges and tsunamis. It updates the discussion of design and decision making in the 21st century, with many new examples presented.

Structures of Coastal Resilience presents new strategies for creative and collaborative approaches to coastal planning for climate change. In the face of sea level rise and an increased risk of flooding from storm surge, we must become less dependent on traditional approaches to flood control that have relied on levees, sea walls, and other forms of hard infrastructure. Instead, authors Catherine Seavitt Nordenson, Guy Nordenson, and Julia Chapman reimagine how coastal planning might better serve communities grappling with a future of uncertain environmental change. They offer inspiring insights into new approaches to design, engineering, and planning, envisioning an ecological approach to developing adaptive and resilient futures for coastal areas.

This book treats the subject of sediment transport in the marine environment, covering transport of non-cohesive sediment by waves and current in- and outside the surf zone. It can be read independently, but a background in hydraulics and basic wave mechanics is required. It is intended for M.Sc. and Ph.D. students. The primary aim of the book is to describe the physical processes of sediment transport and how to represent them in mathematical models. It does not present a large number of different formulae for the sediment transport rates under various conditions. The book can be divided in two main parts; in the first, the relevant hydrodynamic theory is described; in the second, sediment transport and morphological development are treated. The hydrodynamic part contains a review of elementary theory for water waves, chapters on the turbulent wave boundary layer and the turbulent interaction between waves and currents, and finally, surf zone hydrodynamics and wave driven currents. The part on sediment transport introduces the basic concepts (critical bed shear stress, bed load, suspended load and

sheet layer, near-bed concentration, effect of sloping bed); it treats suspended sediment in waves and current and in the surf zone, and current and wave-generated bed forms. Finally, the modelling of cross-shore and long-shore sediment transport is described together with the development, of coastal profiles and coastlines.

Process-based morphodynamic modelling is one of the relatively new tools at the disposal of coastal scientists, engineers and managers. On paper, it offers the possibility to analyse morphological processes and to investigate the effects of various measures one might consider to alleviate some problems. For these to be applied in practice, a model should be relatively straightforward to set up. It should be accurate enough to represent the details of interest, it should run long enough and robustly to see the real effects happen, and the physical processes represented in such a way that the sediment generally goes in the right direction at the right rate. Next, practitioners must be able to judge if the patterns and outcomes of the model are realistic and finally, translate these colour pictures and vector plots to integrated parameters that are relevant to the client or end user. In a nutshell, this book provides an in-depth review of ways to model coastal processes, including many hands-on exercises.

Text on coastal engineering and oceanography covering theory and applications intended to mitigate shoreline erosion.

This book can potentially serve as a comprehensive textbook for students pursuing this subject either as degree or an elective course. It covers all the fundamental physics behind the different phenomena taking place in the near shore regions and the coast as well as the various methods to estimate its impact. Basic knowledge of water wave mechanics is crucial in understanding the coastal processes taking place in the near shore. The assessment of incident forces due to wind, wave, tide, current etc. is important to evaluate the resultant impact they cause on the shoreline and structures. This book emphasizes the importance of sediment dynamics by analyzing the sediment characteristics, the physics of its motion and movement, factors responsible for the fate of sediments etc. It also highlights the erosion problem which is most prevalent across the sandy coasts, additionally erosion combating methods and techniques are also described with real time field problems and their solutions. A wide range of coastal structures and their design principles are included in this book in order to give the reader a holistic understanding to the readers. This book also includes the design challenges and introduces the reliable modeling tools and techniques, which is very useful for beginners working in this discipline.

The book provides a comprehensive and up-to-date overview of the physical processes which, according to the present state of knowledge, determine the evolution of coastal systems and their response to human interventions. This response depends to a large degree on the self-organising properties of coastal dynamics, which form a leading theme throughout the book. The basic theoretical ideas are explained in text and figures and also in formulas for the more mathematically inclined reader. Theories are illustrated with examples from estuaries, coastal lagoons, beaches and tidal flat systems from all over the world. The rules and simple models can be used directly without relying on complex computations; much attention is given to the strengths and weaknesses of the underlying theories and their limits of applicability. The book is fully self-contained; some knowledge of basic physics and mathematics is recommended. The book is an upgrade of the first edition. Most parts are rewritten and chapters are added to incorporate research results, new insight and experience of the past ten years. This book is intended for everyone interested in coastal systems for professional or educational reasons.

In a unitary way, this monograph deals with a wide range of subjects related to the mechanics of sea waves. The book highlights recent theoretical results on the dynamics of random wind-generated waves, on long-term wave statistics, and on beach planform evolution. A fresh approach is given to more traditional concepts. For example, new evidence from a recent series of small-scale field experiments is used to introduce some crucial topics like wave forces. Also, the book gives some worked examples for the design of offshore or coastal structures. An exciting subject dealt with in the book is the quasi-deterministic mechanics of three-dimensional wave groups in sea storms, and the loads exerted by these wave groups on offshore structures. The text is intended for researchers and graduate students in ocean engineering, but may also be understood by undergraduates. The more complex concepts are explained with examples or more extensive case studies.

This book is based on the author's 49 years of experience as a practicing coastal engineer and 34 years as professor of coastal engineering and management at Queen's University. The book is therefore thoroughly practical in nature, but it also reflects newly relevant issues, such as consequences of failure, impacts of rising sea levels, aging infrastructure, real estate development, and contemporary decision making, design and education. This textbook is useful for undergraduate students, postgraduate students and practicing engineers. It covers waves, structures, sediment movement, coastal management, and contemporary coastal design and decision making. It presents both basic principles and engineering solutions. It discusses the traditional methods of analysis and synthesis (design), but also contemporary design methodologies, such as working with environmental impacts. The second edition expanded greatly on the topics of failure and resilience that surfaced as a result of recent disasters from hurricane surges and tsunamis. It updated the discussion of design and decision making for the 21st century, with many new examples. This third edition develops some of these topics further, but its largest new changes is the chapter on climate change. This chapter presents the basics of climate change and then goes on to stress the practical implications of the impacts of climate change, focusing on what is of importance to coastal and fluvial specialists.

The second edition (1997) of this text was a completely rewritten version of the original text Basic Coastal Engineering published in 1978. This third edition makes several corrections, improvements and additions to the second edition. Basic Coastal Engineering is an introductory text on wave mechanics and coastal processes along with fundamentals that underline the practice of coastal engineering. This book was written for a senior or first postgraduate course in coastal engineering. It is also suitable for self study by anyone having a basic engineering or physical science background. The level of coverage does not require a math or fluid mechanics background beyond that presented in a typical undergraduate civil or mechanical engineering curriculum. The material presented in this text is based on the author's lecture notes from a one-semester course at Virginia Polytechnic Institute, Texas A&M University, and George Washington University, and a senior elective course at Lehigh University. The text contains examples to demonstrate the various analysis techniques that are presented and each chapter (except the first and last) has a collection of problems for the reader to solve that further demonstrate and expand upon the text material. Chapter 1 briefly describes the coastal environment and introduces the relatively new field of coastal engineering. Chapter 2 describes the two-dimensional characteristics of surface waves and presents the small-amplitude wave theory to support this description.

Features concepts in coastal engineering and their application to coastal processes and disaster prevention works. This title describes basic concepts of coastal engineering, dealing mainly with wave-induced physical problems. It consists of the author's results of 30 years' scientific research on the progress of coastal sediment transport study.

This book is intended as a handbook for professionals and researchers in the areas of Physical Oceanography, Ocean and Coastal Engineering and as a text for graduate students in these fields. It presents a comprehensive study on surface ocean waves induced by wind, including basic mathematical principles, physical description of the observed phenomena, practical forecasting techniques of various wave parameters and applications in ocean and coastal engineering, all from the probabilistic and spectral points of view. The book commences with a description of mechanisms of surface wave generation by wind and its modern modeling techniques. The stochastic and probabilistic terminology is introduced and the basic statistical and spectral properties of ocean waves are developed and discussed in detail. The bulk of material deals with the prediction techniques for waves in deep and coastal waters for simple and complex ocean basins and complex bathymetry. The various prediction methods, currently used in oceanography and ocean engineering, are described and the examples of practical calculations illustrate the basic text. An appendix provides a description of the modern methods of wave measurement, including the remote sensing techniques. Also the wave simulation methods and random data analysis techniques are discussed. In the book a lot of discoveries of the Russian and East European scientists, largely unknown in the Western literature due to the language barrier, are referred to.

This book is intended as an introduction to classical water wave theory for the college senior or first year graduate student. The material is self-contained; almost all mathematical and engineering concepts are presented or derived in the text, thus making the book accessible to practicing engineers as well. The book commences with a review of fluid mechanics and basic vector concepts. The formulation and solution of the governing boundary value problem for small amplitude waves are developed and the kinematic and pressure fields for short and long waves are explored. The transformation of waves due to variations in depth and their interactions with structures are derived. Wavemaker theories and the statistics of ocean waves are reviewed. The application of the water particle motions and pressure fields are applied to the calculation of wave forces on small and large objects. Extension of the linear theory results to several nonlinear wave properties is presented. Each chapter concludes with a set of homework problems exercising and sometimes extending the material presented in the chapter. An appendix provides a description of nine experiments which can be performed, with little additional equipment, in most wave tank facilities.

Marine and coastal applications of GIS are finally gaining wide acceptance in scientific as well as GIS communities, and cover the fields of deep sea geology, chemistry and biology, and coastal geology, biology, engineering and resource management. Comprising rigorous contributions from a group of leading scholars in marine and coastal GIS, this book will inspire and stimulate continued research in this important new application domain. Launched as a project to mark the UN International Year of the Ocean (1998) and supported by the International Geographical Union's Commission on Coastal Systems, this book covers progress and research in the marine and coastal realms, in the areas of theory, applications and empirical results. It is the first book of its kind to address basic and applied scientific problems in deep sea and coastal science using GIS and remote sensing technologies. It is designed for GIS and remote sensing specialists, but also for those with an interest in oceans, lakes and shores. Coverage ranges from seafloor spreading centres to Exclusive Economic Zones to microscale coastal habitats; and techniques include submersibles, computer modelling, image display, 3-D temporal data visualization, and development and application of new algorithms and spatial data structures. It illustrates the broad usage of GIS, image processing, and computer modelling in deep sea and coastal environments, and also addresses important institutional issues arising out of the use of these technologies.

This book is intended as a useful handbook for professionals and researchers in the areas of Physical Oceanography, Marine Geology, Coastal Geomorphology and Coastal Engineering and as a text for graduate students in these fields. With its emphasis on boundary layer flow and basic sediment transport modelling, it is meant to help fill the gap between general hydrodynamic texts and descriptive texts on marine and coastal sedimentary processes. The book commences with a review of coastal bottom boundary layer flows including the boundary layer interaction between waves and steady currents. The concept of eddy viscosity for these flows is discussed in depth because of its relation to sediment diffusivity. The quasi-steady processes of sediment transport over flat beds are discussed. Small scale coastal bedforms and the corresponding hydraulic roughness are described. The motion of suspended sand particles is studied in detail with emphasis on the possible suspension maintaining mechanisms in coastal flows. Sediment pickup functions are provided for unsteady flows. A new combined convection-diffusion model is provided for suspended sediment distributions. Different methods of sediment transport model building are presented together with some classical models.

This is a comprehensive, detailed coverage of the subject indicated by the title, embracing all aspects from design criteria over design to construction. Basic wave research, wave structure interaction, hydrodynamics, hydraulics, modelling, solid mechanics, soil mechanics, materials execution, maintenance and equipment are all paid equal attention by highly experienced scientists, engineers and constructors in the field. It is a necessary acquisition for practical wave scientists as well as for technicians and engineers.

Sandy beaches represent some of the most dynamic environments on Earth and examining their morphodynamic behaviour over different temporal and spatial scales is challenging, relying on multidisciplinary approaches and techniques. Sandy Beach Morphodynamics brings together the latest research on beach systems and their morphodynamics and the ways in which they are studied in 29 chapters that review the full spectrum of beach morphodynamics. The chapters are written by leading experts in the field and provide introductory level understanding of physical processes and resulting landforms, along with more advanced discussions. Includes chapters that are written by the world's leading experts, including the latest up-to-date thinking on a variety of subject areas Covers state-of-the-art techniques, bringing the reader the latest technologies/methods being used to understand beach systems Presents a clear-and-concise description of processes and techniques that enables a clear understanding of coastal processes

A comprehensive introduction to coastal storms and their associated impacts Coastal Storms offers students and professionals in the field a comprehensive overview and groundbreaking text that is specifically devoted to the analysis of coastal storms. Based on the most recent knowledge and contributions from leading researchers, the text examines coastal storms' processes and characteristics, the main hazards (such as overwash, inundation and flooding, erosion, structures overtopping), and how to monitor and model storms. The authors include information on the most advanced innovations in forecasting, prediction, and early warning, which serves as a foundation for accurate risk evaluation and developing adequate coastal indicators and management options. In addition, structural overtopping and damage are explained, taking into account the involved hydrodynamic and morphodynamic processes. The monitoring methods of coastal storms are analyzed based on recent results from research

projects in Europe and the United States. Methods for vulnerability and risk evaluation are detailed, storm impact indicators are suggested for different hazards and coastal management procedures analyzed. This important resource includes: Comprehensive coverage of storms and associated impacts, including meteorological coastal storm definitions and related potential consequences A state-of-the-art reference for advanced students, professionals and researchers in the field Chapters on monitoring methods of coastal storms, their prediction, early warning systems, and modeling of consequences Explorations of methods for vulnerability and risk evaluation and suggestions for storm impact indicators for different hazards and coastal management procedures Coastal Storms is a compilation of scientific and policy-related knowledge related to climate-related extreme events. The authors are internationally recognized experts and their work reflects the most recent science and policy advances in the field. In the 20 years since publication of the first edition of this book there have been a number of significant changes in the practice of coastal engineering. This new edition has been completely rewritten to reflect these changes as well as to make other improvements to the material presented in the original text. \_ Basic Coastal Engineering is an introductory text on wave mechanics and coastal processes along with the fundamentals of the practice of coastal engineering. This book was written for a senior or first postgraduate course in coastal engineering. It is also suitable for self study by anyone having a basic engineering or physical science background. The level of coverage does not require a math or fluid mechanics background beyond that presented in a typical undergraduate civil or mechanical engineering curriculum. The material presented in this text is based on the author's lecture notes from a one-semester course at Virginia Polytechnic Institute, Texas A&M University, and George Washington University, and a senior elective course at Lehigh University. The text contains examples to demonstrate the various analysis techniques that are presented and each chapter (except the first and last) has a collection of problems for the reader to solve that further demonstrate and expand upon the text material. Chapter 1 briefly describes the coastal environment and introduces the relatively new field of coastal engineering. This book covers water waves, surf zone hydrodynamics, tides in oceans and estuaries, storm surges, estuarine mixing, basic sediment transport, coastal morphodynamics and coastal groundwater dynamics. It is an introductory treatment, suitable for a first course in coastal and estuarine processes for earth scientists or engineers. Yet, there are substantial amounts of new material that are included, such as the explicit, analytical treatment of transient, forced long waves. Inclusion of this material will in turn strongly enhance the introductory treatment of tsunami, storm surges and surf beat. The treatment of sine wave theory emphasizes expressions which are explicit in the water depth  $h$  (using  $k_0h$  instead of  $kh$ ) so that they can easily be differentiated or integrated with respect to  $h$ . This is a major pedagogical advantage because of the enhanced transparency. The treatment of turbulent mixing includes finite mixing length effects which provide an explanation for differential diffusion of different sediment sizes in suspension. The effects of acceleration skewness and boundary layer streaming are also included in the basic sediment transport models. The inclusion of beach groundwater dynamics — including the mechanisms by which waves as well as tides drive groundwater motion — provides a link between the previously unconnected fields of coastal hydraulics and regional groundwater modeling. Serving as a good reference book, it is fully indexed and comprehensively cross referenced. Abundant references to more detailed texts are also provided. Effective coastal engineering is expensive, but it is not as costly as neglect or ineffective intervention. Good practice needs to be based on sound principles, but theoretical work and modelling also need to be well grounded in practice, which is continuously evolving. Conceptual and detailed design has been advanced by new industry publications since the publication of the second edition. This third edition provides a number of updates: the sections on wave overtopping have been updated to reflect changes brought in with the recently issued EurOtop II manual; a detailed worked example is given of the calculation of extreme wave conditions for design; additional examples have been included on the reliability of structures and probabilistic design; the method for tidal analysis and calculation of amplitudes and phases of harmonic constituents from water level time series has been introduced in a new appendix together with a worked example of harmonic analysis; and a real-life example is included of a design adapting to climate change. This book is especially useful as an information source for undergraduates and engineering MSc students specializing in coastal engineering and management. Readers require a good grounding in basic fluid mechanics or engineering hydraulics, and some familiarity with elementary statistical concepts.

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