

Offshore, the continental shelf is relatively narrow with its shelf break around 100 m. The tidal range is 1–3 m, and, with an uninterrupted seaward fetch all the way from the Southern Ocean, the beaches are mainly high angle with plunging breakers 2–3 m high. Longshore currents are commonly 0.5 to 1 m/second, but tidal inlets register up to 2.8 m/sec. Rapid change in MSL would, of course, cause an abrupt deepening of the shelf waters, amplifying the wave dynamics and current velocities. With rising sea level, tide ranges tend to become greater. Appreciable capital expenditures for expanding coastal defense systems and harbor facilities should be anticipated. A real loss of ground in the Niger delta would adversely affect also the fishing industry, with its strong dependency on wetlands and mangrove swamps. Some 90% of Nigeria's foreign exchange depends on oil exports, an industry largely concentrated in the delta and its offshore face.

What can be done? Present data available are considered too scanty to permit trustworthy monitoring. Monitoring contemporary change is needed in a much more widespread manner. Knowledge of rates of sea-level rise in the recent geological past would be particularly useful . . . "Now is the time to act. . . ."

The political and administrative recommendations are summarized and are worth reading. Most of the articles are adequately references, and a useful index is provided. What is missing, regrettably, is any hint of hard data. Its collection calls for much expenditure of both intellectual effort and solid funds.

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Basic Wave Mechanics for Coastal and Ocean Engineers, Robert M. Sorensen, 1993. John Wiley and Sons, Inc., New York. ISBN 0-471-55165-1.

A distinguishing characteristic of this book on water wave mechanics is an emphasis on description of the physical processes without presentation of the detailed mathematical derivations. Material is well organized and presented in a compact form, with a generally complete and insightful discussion of mechanisms, applications and

methods of solution without pursuing their derivations. There is a rich and fairly current list of references. The material interfaces with many applications; however, because in part to the length of the book, the applications are not investigated. It would seem to this reviewer that the decision of where to truncate a subject and its extension to associated applications must have been difficult, although the author has done this cleanly. The book is intended as a text, although no problems are included. The character of this book would seem to make it appropriate for advanced undergraduates and first-level graduate students; however, the lack of mathematical derivations would be a hindrance to a student planning advanced graduate studies in the field of water waves. The book is organized into 10 chapters encompassing the range of interests to coastal and ocean engineers. Each of these chapters is reviewed below.

Following a brief first chapter—"Sea Surface Gravity Waves", which describes the general character and physics of water waves in nature and identifies other available references on the subject including journals and reports from various laboratories—the second chapter, "Small Amplitude Wave Theory and Characteristics", presents, without derivation, equations for the kinematic and dynamic properties of the first-order (small amplitude, *i.e.*, Airy) wave theory. In some cases, the approaches to determining the results are outlined. Chapter 3, "Two-dimensional Wave Transformation", applies the results of Chapter 2 and introduces additional concepts to treat changes that occur to waves as they propagate directly toward shore. Discussed are: shoaling due to changes in water depth, changes in wave height due to wind, bottom friction, and also percolation and dissipation in soft mud bottoms. The effects of vertical asymmetry (crests higher than troughs) due to nonlinearities and horizontal asymmetry (forward face of a wave steeper than the trailing) due to shoaling are described. Breaker types and their respective ranges of parameters are established. The chapter concludes with a discussion of wave set-down, set-up, and wave run-up. Where appropriate and available, equations and/or empirical results in the form of graphs are presented. Chapter 4, "Finite Amplitude Wave Theory", describes the classical analytical (Stokes, Cnoidal and Solitary) and numerical nonlinear theories and their respective ranges of applicability. As in other chapters, limited equations are

presented. The effects of nonlinearity are discussed and results (for example on shoaling) presented in graphical form. Chapter 5, "Three-dimensional Wave Transformations", explores wave refraction over irregular bathymetry and wave diffraction behind a breakwater and reflection from structures. Classical and modern approaches to developing refraction diagrams and to calculating the effects of refraction, including the effects of currents, are discussed. The classical diffraction results of Penny and Price which represent wave interaction with breakwaters including gaps are presented. The representation of combined refraction/diffraction by the mild slope equation is introduced. Finally, the phenomena of wave reflection including formation of Mach Stem waves and waves generated by moving objects are presented.

Chapter 6, "Wind-generated Waves", commences with a clear and thorough description of the physical processes associated with wave generation in the open sea. The characteristics of the resulting waves, including their spectral and probabilistic representations, are described. The joint distribution of wave height and period is described. Various forms for the one-dimensional and directional spectra are discussed, including the studies that led to their development. Methods for wave height and period prediction based on meteorological characteristics are reviewed, including graphical and numerical procedures. Included are effects of shallow water and the decay after the waves propagate away from the generating areas. Chapter 7, "Design Wave Determination", opens with a discussion of the range of applications which require establishment of a design wave height and period. For some applications, it is necessary to identify the maximum wave height expected during the life of the structure, and for others the wave height associated with the cumulative energy may be more representative. Dynamic systems may require emphasis on wave periods that could cause resonance. Various means of wave observation and measurements to obtain wave data are discussed. Several approaches for extreme wave analysis and their applicabilities are reviewed. Finally, the limitations placed on waves due to breaking are described.

Chapter 8, "Wave-Structure Interaction", addresses the effects that various types of structures have on wave phenomena, including dissipation, reflection, transmission and run-up and overtop-

ping. Typical fixed engineered and natural (beaches) structures are included as well as floating structures that may be used as docks or breakwaters. Results from some experimental investigations are presented. Chapter 9, "Long Waves", provides the most detailed treatment of the book and commences with the Navier-Stokes equations, makes the appropriate simplifying assumptions and solves the equations which, for the most simple case, are shown to be the same as obtained by simplifying the small amplitude relationships (Chapter 2) for shallow water. Conditions of wave resonance in idealized closed and open (at one end) harbors are presented. Effects of the Coriolis force and the resulting Kelvin waves are described. Effects of a surface pressure disturbance translating at constant speed are investigated and the resulting resonance shown if the translation speed is close to that of a long free wave in the water depth of interest. Storm surges due to barometric pressure anomalies and surface wind stresses are examined. Finally, an outline is presented of procedures used in the numerical modelling of long wave phenomena in the presence of complex boundary conditions. The final chapter, Chapter 10, "Laboratory Investigation of Surface Waves", commences with a review of laboratory modelling relationships for dynamic similitude and the special role of Froude modelling in water wave investigations. Distorted models in which the vertical scale is larger than the horizontal causes effects which may be acceptable in certain types of investigations, for example, wave refraction, but serious errors can occur if wave diffraction is significant. Various means of generating laboratory waves, including some of the associated wave-maker theories, are reviewed as is the generation of spurious short and long wave generation and the means to their avoidance. Wavemaking of both monochromatic and irregular waves is examined and concepts of directional wave generation in the laboratory are presented. Wave absorbers at the downwave end of the tank are desirable to limit the amount of wave reflection and various approaches to accomplishing this objective and their efficiencies are discussed.

In summary, this book provides an excellent synthesis of many hundreds of references as well as the research contributions and experience of the author into a coherent form that reads well and is easily understood by a civil engineering student who may have an interest in majoring in coastal and/or ocean engineering at the graduate

level. The author's stated objectives are "to present first a discussion of the physical processes involved in ocean wave mechanics and second the analytical basis of these processes at the level required by the marine engineer and scientist". This reviewer concludes that these objectives have been well accomplished and that through an understanding of the material and the references provided for additional reading, this book provides a good basis for a practical understanding of water wave phenomena and their engineering applications. It is most suitable for an engineer or engineering student needing a working knowledge of the subject that does not require application to situations not covered or to further theoretical studies of water waves.

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Geomorphology of Rocky Coasts, by Tsuguo Sunamura, 1992. John Wiley & Sons, Ltd., Chichester, U.K., 302p. ISBN 0-471-91775-3.

This book, representing the third volume in the Coastal Morphology and Research Series, examines rocky coasts from an engineering, as well as a geomorphological perspective. The book begins with a brief review of wave dynamics, tides, and rock mechanics (chapters 2-4), which forms the physical basis for an understanding of cliff recession (chapter 5) and bedrock lowering (chapter 6). Following the discussion on erosional processes, characteristic rocky coast landforms are described (chapters 7, 8). The final chapter reviews the impacts of human activity on rocky coasts, including effects of future sea level rise on cliff erosion. The book features an extensive bibliography (28 pp.) and a global compilation of coastal cliff recession rates which can reach up to 30-40 m/yr in unconsolidated glacial clays and pyroclastics.

An important theme throughout the book is that rates of cliff erosion or submerged bedrock lowering are governed by two competing forces: the attacking force of waves, F_w , and the resisting force, F_r , determined by the rock mechanical strength. Mathematical relations between relevant parameters are developed, based on field and

laboratory measurements. While the wave assailing force, F_w , is directly related to wave energy, it also depends on the nearshore bottom topography, presence of beaches, and water level, including tides, and surges. Because of the complexity of the problem, no quantitative index for F_w has yet been established. However, the compressive strength of rocks has been used as an index for the resisting force, F_r .

Erosion rates vary considerably over time and space. Short-term recession, caused by major storm events, is much greater than the long-term averages. Lithology exerts a strong influence, too: rates are as low as 10^{-1} m/yr in granitic rocks to ~ 10 m/yr in unconsolidated volcanic ejecta. Where lithology is similar, erosion rates vary, depending on wave conditions. The strength of cliff material also determines the relation between erosion rates and beach elevation. Over short time spans, erosion rates are affected by cliff height, but this relation becomes less pronounced as the time span increases. Lowering of seafloor profiles is also examined (chapter 6). Important controlling factors are the depth of the sediment cover, bedrock lithology, including physical discontinuities (fractures, joints, bedding), and biological activity (grazing and boring organisms).

A two-fold classification of the cliff-ocean interface is presented: 1) cliffs with shore platforms, and 2) plunging cliffs (chapter 7). The former is further sub-divided into two classes: Type-A platforms, with a gentle seaward slope, and Type-B platforms that are horizontal, with a sharp seaward drop. Models of platform development are reviewed. Sunamura proposes a complex physical model for rates of recession for Type-A and Type-B platforms, and also examines relations controlling platform elevation and width. These are then integrated into a rocky coast evolution model for periods of prolonged sea level stability. Widespread applicability of his model may be limited by the large number of parameters, and constraints of data availability.

Plunging cliffs are formed by drowning of pre-existing, wave-formed cliffs, due to land-subsidence and/or the post-glacial marine transgression. They can also be associated with neotectonic activity, including faulting and volcanism. While cliff submergence is a prerequisite, their preservation implies a sufficient rock strength to resist erosive wave action, during a sea level stillstand.

Selected erosional landforms are discussed in chapter 8. These include notches, sea caves, sea