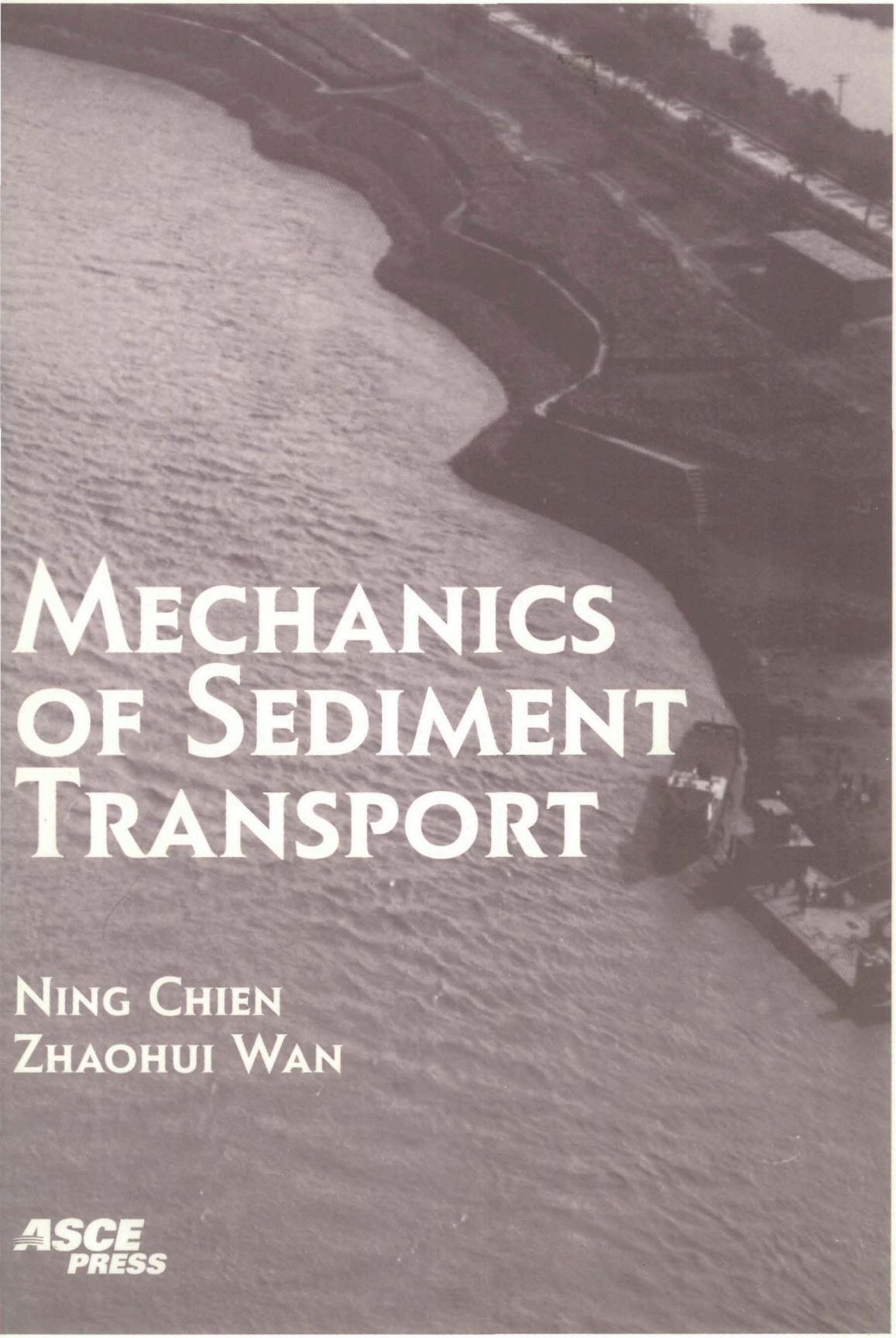

Mechanics of Sediment Transport

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ASCE PRESS

MECHANICS OF SEDIMENT TRANSPORT

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Abstract: This book is a comprehensive treatise on the mechanics of sediment transport. It covers every essential phase of the subject by examining the processes of erosion, transportation, and deposition of sediment particles under gravity, flowing water, wave, and wind. In its original form, it has become the standard textbook in Chinese universities and the main reference used by practicing engineers in China. Now fully translated and updated, this volume will prove to be invaluable to the student, academician, researcher, and practitioner.

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FOREWORD

This book by the late Dr. Ning Chien and his student Dr. Zhaohui Wan, is based on their experience of teaching and practicing in the field of engineering sedimentation accumulated mainly in China for about forty years. The first draft of this book was completed in 1951 by the senior author while he was a staff of the sedimentation laboratory led by the late Professor H.A. Einstein at the University of California at Berkeley. Between 1955 and 1986, Dr. Chien conducted numerous classes on mechanics of sediment transport for graduate students and hydraulic engineers with these notes in China. Up until 1982, about 830 engineers and graduate students attended these courses. Intensive discussions were conducted in the classes and, based on these discussions, revisions of the notes were carefully made. The result is a book culminating in logic and clearness of presentation.

Research engineers and university professors in China are often asked to do consultant work for engineering projects. The authors are no exceptions. Thus Dr. Chien had conducted reconnaissance of many major rivers in China, especially the Yellow river. For several years, he was stationed at Zhengzhou on the right bank of the lower Yellow River, from which he made numerous inspection tours to different parts of the River, ranging far upstream and all the way downstream to the estuary. For closer observation, in most cases these trips were made on foot under primitive and rough conditions. His first-hand and in-depth knowledge of the river gained in this down-to-the earth approach eventually earned him the reputation of modern-time authority on the Yellow River. Practical knowledge plus a strong theoretical background enabled Dr. Chien to offer valuable advises to many important river-training projects in China. This practical spirit also impregnated the writing of the book. Thus, although the book contains a wealth of theoretical material, the selection and the presentation are by no means academic.

The book is a comprehensive treatise on the mechanics of sediment movement. It covers every essential phase of the subject and is now the standard textbook in Chinese universities and the main reference used by practicing engineers in China. The edition in Chinese was published by the Science Press in Beijing. Over five thousand copies of three printings have been sold. To readers outside China, it is perhaps worthwhile to mention that the book also incorporates Chinese developments on the subject or references thereof otherwise not available to the outside world. In the last decades, out of necessity, large-scale hydraulic constructions have been carried out in China on large streams that are mostly sediment-laden and present many sedimentation problems. To solve these problems, a great deal of research has been conducted. Results obtained prior to 1983 have been reviewed in this book, while references to many later developments are appended in the end.

Last but not least, it is indeed fortunate that the quality of the edition in English was immensely enhanced by Professor John S. McNown, who patiently and

thoroughly revised all draft translations performed by Chinese engineers to render them correct, accurate and readable. Professor McNown is an authority in sedimentation himself. He is also a member of the American Engineering Academy and an honorary member of the International Association of Hydraulic Research (IAHR). The contribution to the English edition made by such a distinguished scholar is greatly appreciated.

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PREFACE

Mechanics of sediment transport is a branch of basic technical science in which the processes of erosion, transportation, and deposition of sediment particles take place under action of gravity, flowing water, wave, and wind. It is an independent discipline of science. Although a number of specialized writings have already been published, this book is the first attempt to unify in detail the movement of sediment under a variety of dynamic actions and boundary conditions. In the late 1940's, I started to collect relevant material abroad and prepared lecture notes from them; I used them in lectures at universities, research institutes, and engineering departments after returning to China. The manuscript had been revised several times on the basis of comments from the audiences and students, and also by the addition of new research results on developments in this branch of learning. By the early 1960's, the first 16 chapters had been completed. The first 12 chapters were distributed in a mimeographed manuscript entitled "Basic Law of Sediment Transport," and it has been reproduced several times by different institutions. In the latter part of the 1970's, I revised the original manuscript thoroughly and amended it by adopting new achievements in this field of learning both at home and abroad; I also expanded the volume into the present book by adding five more chapters. Dr. Zhaohui Wan assisted in the writing of Chapters 2, 3, 4 and, 12.

The writing of this book was begun while I was still at an age in the prime of life and ended at the age with greying temples. The manuscript was finally sent for publication only after many trials and vicissitudes of life over a span of 30-odd years. I devote this book to the people who are working assiduously in the scientific and engineering field of sedimentation in the construction of modernization of our motherland. I will be greatly rewarded if this book is of some help in their work.

It was under the guidance of Prof. Hans A. Einstein that I started to work in the field of sediment science. I worked with him for seven years with sincere and deeply friendly feelings. His thorough and inspiring instruction is still lingering in my ears. It was deeply regretted that he passed away just before his planned visit to China so that he was unable to see for himself the flourishing development of sediment science in China. Allow me to express a few words here both my grief and fond memories of my dearest Professor.

The completion of this book cannot be separated from the great support and assistance of my wife Wei-yao over the past several decades, especially the difficult times we together had gone through. I wish to express my sincere gratitude for the valuable comments on the manuscript from Professors Shunong Zhang, Jiahua Fan, and Guoxiang Hua. I wish also to express my gratitude for the careful proof reading by Meiqing Yang and Baoyu Chen, and the extensive work in the drafting of the figures by Tianjin Jiang.

Ning Chien