Book Review

Review of An Introduction to Hydraulics of Fine Sediment Transport by Ashish J. Mehta


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The study of fine sediment dynamics is important to maintaining navigation, tracking contaminants, sustaining water clarity, and preserving wetlands, among many other applications. However, obtaining or teaching a broad understanding of the topic is hampered by the fragmentation of findings across many different engineering and science journals as well as proceedings volumes. An Introduction to Hydraulics of Fine Sediment Transport by Ashish J. Mehta, is a remarkably thorough and timely synthesis of this subject. There have been relatively few texts focused on fine sediment transport in recent years, and none have been this comprehensive—for instance, this text literally includes a thousand references in its bibliography. Mehta's emphasis on the results of field and laboratory experiments makes this book a useful companion to the more theoretically based Introduction to the Physics of Cohesive Sediment Dynamics in the Marine Environment by J. C. Winterwerp and W. G. M. van Kesteren in 2004 (Elsevier, New York).

Although aimed at graduate students and advanced undergraduates in civil and coastal engineering, this new text will also be a valuable tool for graduate students in environmental engineering, coastal and marine geology, and physical geography, among other fields. There is more than enough material here for a semester course, and chapters can be selected to best fit the emphasis of a specific program curriculum. Given the dearth of comprehensive, up-to-date texts on fine sediment transport, this new addition will make the job of teaching this subject easier for years to come. Just as significantly, this book will provide a logical first-stop reference for practicing engineers and researchers working in the field.

More than a thousand pages in length, this book consists of 12 chapters, plus six appendixes, a 52-page bibliography, and a 13-page index. Each of the chapters begins with an abstractlike overview and ends with a set of student exercises. Chapters 1–3 contain a general introduction to the text, followed by a review of key topics in fluid and wave mechanics, and then a summary of approaches to sediment classification. The most valuable chapters are 4–12, however, which focus on especially useful past findings within various subtopics of fine sediment dynamics, many of which continue to be rapidly evolving areas of ongoing research. Given the diversity of subtopics, it is difficult to know what the best order might be to present Chapters 4–12 to students. A few of the chapters directly build upon each other; for example, rheology (Chapter 5) is needed before addressing fluid mud (Chapter 10) which, in turn, is needed before the study of wave-mud processes (Chapter 11). Likewise, the topics of flocculation (Chapter 4), settling (Chapter 7), and bed formation (Chapter 8) should be read in order. Other subjects, such as transport relations (Chapter 6), erosion (Chapter 9), and sedimentation phenomena (Chapter 12), less obviously require consideration in a specific sequence.

A specific strength of this book is its focus on the simplest scientifically justified formulations possible to obtain a useful quantitative result in each application considered. As the author writes in the text’s preface:

Recent research suggests a shift towards the application of computational fluid dynamics to identify complex, non-linear causes and effects in fine sediment transport. . . However, in typical coastal engineering projects, the need to carry out back-of-the-envelope calculations is unlikely to diminish, and to a fair extent this work is meant to support that need.

Another valuable aspect of this text is the bridge it provides across generations, synthesizing insights from the past with more recent findings. Ashish Mehta studied under several of the founders of coastal engineering, and has since personally educated or collaborated with many of the stars of its latest generation. The coastal engineering community is fortunate that Mehta has taken the time to synthesize so much of his knowledge on fine sediment transport within this important new text.