



BOOK REVIEW

HYDRODYNAMICS AROUND CYLINDRICAL STRUCTURES, B. M. Sumer and J. Fredsøe, World Scientific, Singapore.

With the authoritative text on flow past a cylinder, “Mechanics of Wave Forces on Offshore Structures” by Sarpkaya & Isaacson (1981), having been out of print for several years, there is a gap in the market which has only partially been filled by the books of Chakrabarti (1987), Faltinsen (1990) and Blevins (1990). Sumer and Fredsøe attempt to plug the gap with their book which aims to explain the flow pattern around, fluid loading on, and response of, cylindrical structures at a level accessible to postgraduate research students. The book focuses primarily on the drag-dominated regime, and may be divided into two roughly equal halves, the former dealing with the fundamentals of fluid loading on fixed small diameter cylinders, the latter dealing with flow-induced vibrations of small diameter cylinders.

On the whole the text is very readable, particularly the introductory chapters on fluid loading on cylinders in steady currents, oscillatory flows and waves. It contains much useful insight into the relationship between flow physics and fluid loading. There is an excellent physical explanation of the cross-flow principle backed up with experimental evidence, and a close examination of its limits for application. The chapter on theoretical treatment of flow past a cylinder should be extremely useful for M.Sc. and Ph.D. students starting off on numerical modelling of bluff-body flows. The sections on instability analysis contain much of the historical background, and are well explained. Useful tables are presented summarizing theoretical solutions of the 2-D Navier–Stokes equations for flow past a cylinder and comparing the transport of species and vorticity. There is no discussion of 3-D numerical modelling of flow past a cylinder (e.g., Yeung & Yu, 1995). The book contains detailed descriptions of the hydrodynamic forces on pipelines near fixed erodible beds. The later chapters on flow-induced vibrations start from a base similar to that covered by Blevins (1990), but give much more coverage of pipeline vibrations.

In the reviewer’s opinion, the book has two drawbacks. The first is the presumption that planar oscillatory flow and wave flow are hydrodynamically the same. This implies that nonplanar orbital hydrodynamics may be neglected as can free-surface effects; this is plainly not true. Consequently, much of the beginning of the Chapter 4 “Forces on a cylinder in regular waves” would have been better placed in a separate chapter on “Forces on a cylinder in planar oscillatory flow”. Chapter 9 is primarily concerned with planar oscillatory flow even though its title implies wave flow. Section 11.2 should have been titled “The oscillatory flow case” instead of “The wave case”.

The second drawback is the lack of information on recent advances in understanding of the diffraction regime. The preface baldly states that “a small chapter on diffraction is included for the sake of completeness” because it is the drag-dominated regime for which “the most progress and development have taken place during the last almost 20 years since Sarpkaya and Isaacson’s book”. This unfair comment neglects several major theoretical advances that have occurred in the analysis of structures in the inertia regime such as third-order diffraction theory, the numerical wave tank, and the interaction of steep waves with large diameter cylinders. No mention is made of slender-body theory (see Rainey 1995).

or the perturbation approach proposed by Faltinsen *et al.* (1995). The book is somewhat too biased towards the authors' research interests. On a more minor note, there are a large number of small spelling and typing errors which hopefully will be eradicated from future editions; in places the text is rushed and too much like a literature review.

On balance, allowing for the limited treatment of diffraction and the muddle over planar oscillatory and wave flows, "Hydrodynamics Around Cylindrical Structures" is worth recommending to postgraduates researching into offshore hydrodynamics. Without altering the fundamental emphasis of the work, a future edition of the book could be expanded to include case histories, design examples and a vectorial approach (e.g., Borgman 1958) for calculating wave loads on inclined cylinders so as to be accessible to the wider offshore engineering community.

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