

## Book review

**Liquid Sloshing Dynamics: Theory and Applications. Raouf A. Ibrahim. Cambridge University Press, Cambridge, UK (2005).**

The book by Professor Ibrahim is a monumental work on liquid sloshing in stationary or moving containers. The prestigious Foreword of Dr. Norman Abramson, who published for the NASA what can be considered the progenitor of this book exactly 40 years ago, opens the manuscript. The text is organized in four main parts: (I) linear sloshing dynamics; (II) nonlinear and parametric sloshing dynamics; (III) sloshing–structure interaction; (IV) rotating fluid and low gravity sloshing.

In particular, Part I is dedicated to sloshing in rigid tanks described with linearized equations; here the reader can find analytical and numerical solutions for virtually all the cases studied in the literature, which makes this section a fundamental reference for professionals and researchers working in this area. Free oscillations are confined to Chapter 1, while forced sloshing can be found in Chapter 2; damping and sloshing suppression devices are described in Chapter 3.

Part II, which is composed by four chapters, addresses the more complex phenomena of nonlinear sloshing related to large amplitude waves and nonlinear coupling of modes, including those giving rise to the well-known rotary sloshing, by introducing the most recent mathematical and numerical techniques for nonlinear dynamics. Faraday waves (parametric sloshing) and sloshing impacts are treated in this section.

The linear and nonlinear sloshing in flexible containers is addressed in Part III, where many new researches on liquid-filled shells are presented; including advanced nonlinear structural models to describe the tanks. Linear models are described in Chapter 8; nonlinear interaction is studied in Chapter 9; the tuned sloshing absorbers are described in Chapter 10 with very interesting applications, including ships and civil engineering.

The last part of the book contains Chapters 11 and 12; in the first one, the reader can find the dynamics of rotating fluid and sloshing in spinning containers. Sloshing in microgravity is studied in Chapter 12, where advanced problems are addressed: (i) acceleration fluctuations known as g-jitter, (ii) liquid surface deformation during outflow, (iii) capillary system, (iv) thermocapillary convection, and (v) cryogenic liquids.

The theory is fully developed so that the book is self-contained with many applications: in space vehicles, civil engineering, storage tanks, ships, and road vehicle tanks. The book ends with an impressive list of more than 2600 references.

I take this opportunity to convey my compliments to Professor Ibrahim for writing such a complete and necessary book, and for making it attractive and clear. I would strongly recommend the book to everybody interested in fluid or structural dynamics, and in particular to all readers of the *Journal of Fluids and Structures*. It can be fully read or it can just be used as a fundamental reference, or as a source to find examples of complex dynamics or the solution to practical problems.

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