ELSEVIER
Journal of Fluids and Structures 19 (2004) 1027–1028
JOURNAL OF FLUIDS AND STRUCTURES
www.elsevier.nl/locate/jnlabr/yjfls

Book review

Discrete Systems François Axisa, Kogan Page Science, London, 2004

This is the first volume of a four-volume set on *Modelling of Mechanical Systems* to appear in English; the whole set has already been published in French in 2001 *(Modélisation des systèmes mécaniques*, Tomes 1–4; Hermès Science, Paris). If the French version of Vol. I was merely very good, the English one is simply excellent! For this is not just a translation; much has been added, refined and polished, to make this book an excellent addition to anyone's bookshelf, whose interests lie in Dynamics, Vibrations, or Fluid Structure Interactions. The comments that follow will, I hope, make this plain.

This book presents the fundamentals of Mechanics in a rigorous, yet very readable, manner. I echo Professor D.J. Ewin's Foreword, who says that the treatment is a happy marriage of the more abstract and rigorous French tradition and the more pragmatic Anglo-Saxon one. However, there is more to the French tradition than classical rigour: namely the enthusiastic espousal of modern methods and techniques; in this context, numerical methods—interspersed even within this volume, the contents of which are largely classical.

Although confining the treatment to discrete systems (continuous, or distributed parameter, systems are the subject of Vol. II), this book presents a thorough treatment of Dynamics in all its kaleidoscopic variety. Starting with Newtonian dynamics (Chapter 1), it goes on to analytical mechanics (Chapters 2 and 3) with the discussion of Lagrange's equations, derived from both the virtual work and Hamilton's principle axiomatic starting points. This is a very thorough treatment, with emphasis on the convenient matrix formulations for linear systems, not shying short of discussing such items as Hermitian matrices, variational mechanics, bifurcation concepts, and stability—in a readable, well-illustrated manner. Among the examples presented are the dynamics of buildings on elastic foundations and the buckling of articulated rods. This is completed by a discussion of constrained systems and Lagrange multipliers (Chapter 4), including nonholonomic constraints.

Chapter 5 deals with one-degree-of-freedom autonomous systems in a full-fledged coverage, involving undamped and damped systems, phase-space concepts, nonlinear and self-excited systems, stability concepts, and numerical solutions. Discussions of the Duffing and Van der Pol oscillators, parametrically excited systems, and impact oscillators are also included.

The treatment is extended in Chapter 6 to multi-degree-of-freedom linear systems, making extensive use of matrix formulations, eigenvalue methods and decoupling techniques. However, the text is peppered with some unusual, welcome features: e.g., covering the concept of load-induced divergence (buckling), waves in chain-like structures, and whirling of rotating systems; these concepts are clearly elucidated on simplified versions of these systems.

Chapter 7 on response to transient excitation, which is accorded an unusually thorough treatment, is mainly concerned with linear systems and demonstrates the power and advantages of Laplace transform methods.

Chapters 8 and 9 are interesting, unique contributions, not usually found in books on Dynamics or Vibrations. Chapter 8 presents the mathematical foundations for spectral analysis of deterministic time-signals and covers such items as Hilbert spaces, Fourier transforms, spectral analysis, and digital signal processing. Usually one has to refer to a different kind of book for some of this information; so, it is doubly appreciated to find it here, succinctly and clearly developed.

In Chapter 9 the methods of the previous chapter are utilized to deal with a variety of interesting problems. In this chapter particularly, because of the selection of material and the perspective, it is clear that this book has been written by a highly qualified engineer and seasoned researcher who has had long experience in dealing with real mechanical systems at a high technological level. The chapter ends with a very nice treatment of the forced oscillations of the Duffing oscillator, including chaotic motions.

The book is concluded by eight appendices, which give the basics of things that a reader may have forgotten, e.g., Euler's angles and the kinetic energy of rotating rigid bodies, LU-decomposition of asymmetric matrices, and Laplace transforms. The benefit of these appendices is to transform this to a self-contained reference book—particularly useful for those not intimately and continually enmeshed in this type of work.

doi:10.1016/j.jfluidstructs.2004.06.002

The overall impression I had upon first perusing this book was one of excitement: so many nice things to sample and enjoy! More careful reading has reinforced my admiration for the book, which I reiterate would make an excellent addition to anyone's bookshelf. I look forward to the publication of the other three volumes: *Vol. II. Continuous Systems; Vol. III. Fluid-Structure Interaction; Vol. IV. Flow-Induced Vibration.* If the relatively dry topic of Vol. I could be made exciting; one can but anticipate the joys of Vols. III and IV!

Michael Païdoussis
Department of Mechanical Engineering,
McGill University,
817 Sherbrooke Street West,
Montreal, Québec, Canada H3A 2K6
E-mail address: maryf@mecheng.mcgill.ca