journal of dynamic systems, measurement, and control

book reviews

APPLIED MECHANICS: MORE DYNAMICS, by Charles E. Smith, John Wiley & Sons, Inc., 1976, 244 pp.

REVIEWED BY GEORGE R. SPALDING[1]

When this book arrived from the publisher, the reviewer was planning a one quarter course in advanced dynamics which was to contain applications to inertial systems. The intention was to present rigid body dynamics, rotating coordinate systems, linear coordinate transformations, Lagrange's equations and gyroscopic motion, and then to apply these concepts to gyroscopic devices and inertial systems. The applications were to be taught from selected technical articles. The major problem, until Professor Smith's book arrived, was finding a text that covered these basic topics in a continuous and concise manner.

More Dynamics met the requirements perfectly. It contains five chapters, the first four of which cover the material necessary for an understanding of gyroscopic systems.

The first chapter starts with the time derivative of a vector in a rotating space, develops the velocity and acceleration relationships, briefly discusses particle kinetics, and ends with general motion of a rigid body. Rotating frames of reference are always emphasized.

The next chapter begins with basic linear algebra and goes through coordinate transformations and the determination of principal directions. For most engineering students, this material will not be new; however the examples and the problems at the end of the chapter serve as an excellent review.

The third chapter contains a fine discussion of rigid body rotational displacements, Eulerian angles and small angle approximations. This chapter also presents angular momentum, kinetic energy, Newton's second law, and ends with a limited discussion of the top problem.

The development of Lagrange's equations, from virtual work, is treated in the fourth chapter. Degrees-of-freedom, generalized coordinates, potential functions and the derivation of the equations are clearly and concisely presented. This is followed by a brief discussion of the Hamiltonian, energy integrals, and the top problem, this time approached from the Lagrangian.

The book's final chapter is an excellent undergraduate-level discussion of the dynamics of engineering systems. The important points are here, presented in a straightforward manner. The emphasis is on linear constant parameter systems and the meaning and consequences of linearity. The transition from the discrete model to the spatially distributed one is very well made. There is a discussion of linearization, and the chapter concludes with a few pages on some common nonlinear characteristics.

The first four chapters provide an excellent background for further work on inertial navigation. The notation used to distinguish reference frames was particularly well chosen. For example, if α and β designate two coordinate systems rotating with respect to each other, then the equation

$$\overset{\alpha}{A} = \overset{\beta}{A} + {}_{\alpha}\Omega_{\beta} \times A$$

indicates that the time derivative of A in α-space equals the time derivative in β-space plus the angular velocity of β as observed from α, crossed with A. The students liked this notation very much.

While the final chapter is excellently done, it does not fit naturally at the end of the other four. It does not build on them, nor apply the concepts developed in them. A chapter which did would, in the reviewer's opinion, improve this otherwise excellent text.

[1]Department of Engineering, Wright State University, Dayton, Ohio.

NOTES ON NONLINEAR SYSTEMS, by J. K. Aggarwal, Van Nostrand Reinhold Notes on System Sciences, 1972, 201 pp., Paperback.

REVIEWED BY S. H. JOHNSON[1]

As part of a series of such books, Van Nostrand Reinhold has published the classnotes for a one-semester interdisciplinary course on the methods of qualitiative quantitative and numerical analysis of systems of nonlinear ordinary differential equations. These notes have been used with first-year graduate students and seniors at the University of Texas. It has been used for a half semester course segment for Lehigh graduate students. The book is intended to complement the presentation in two other books in the same Van Nostrand-Reinhold series: *Notes for a First Course on Linear Systems*, by Polak and Wong and *Notes for a Second Course on Linear Systems* by C. A. Desoer.

The book contains the things one would expect: Phase-Plane Methods, Stability of Linear and Nonlinear Systems, Limit Cycles and Ultimate Bounds, Approximation Methods and Numerical Integration Algorithms. The presentation of the material is particularly appealing. Many topics are developed in same fashion as they evolved historically. Examples and exercises are taken from the literature with the sources cited. Unfortunately this technique has not been well executed in detail. Information is omitted from the exercises which would greatly reduce the drudgery. The reader is asked to sketch trajectories for Rapoports' arms-race equations without being provided numerical values for the parameters. If the reader consults the cited reference he fails to find numerical values which would make an interesting and demonstrative exercise and fails to find the equations attributed, albeit somewhat obliquely, by the author to that reference.

There are a few mistakes or omissions in the book but too few to be annoying. All of the numerical results in the computer methods chapter have been reproduced without discrepancy. The book is physically ill-suited to use as a text. Pages fall out so often that students resort to drilling holes in the book and converting it to loose-leaf form. The Editor's Note inside the back covers says that a clothbound library edition is also available.

Despite the shortcomings, the book is useful and will be used again by the reviewer.

[1]Associate Professor of M.E. and Mechanics, Lehigh University, Bethlehem, Pa.

Applied Mechanics (Dynamics). December 2017. ISBN: 9789937031882.Â Many studies of long bone cross-sectional geometry have examined second moments of area rather than section moduli. Read more. Conference Paper. Design of a smart superstructure FBG torsion sensor.Â Bioreactors can also be used to apply mechanical constraints during maturation of the regenerating tissue for studying and understanding the mechanical factors influencing tissue regeneration. In this work, the main types of bioreactors used for tissue engineering and regeneration, as well as their most common applications, were reviewed and compared. Applied Mechanics and Dynamics Conference aims to bring together leading academic scientists, researchers and research scholars to exchange and share their experiences and research results on all aspects of Applied Mechanics and Dynamics Conference. It also provides a premier interdisciplinary platform for researchers, practitioners, and educators to present and discuss the most recent innovations, trends, and concerns as well as practical challenges encountered and solutions adopted in the fields of Applied Mechanics and Dynamics Conference. Upcoming Events. Applied mechanics is a branch of the physical sciences and the practical application of mechanics. Pure mechanics describes the response of bodies (solids and fluids) or systems of bodies to external behavior of a body, in either a beginning state of rest or of motion, subjected to the action of forces. Applied mechanics bridges the gap between physical theory and its application to technology. It is used in many fields of engineering, especially mechanical engineering and civil engineering; in this