Book review

Advanced Engineering Dynamics (2nd Edition) by Jerry H. Ginsberg, Published by Cambridge University Press, 1995.

This is a second edition of the book "Advanced Engineering Dynamics" by Jerry H. Ginsberg. As the author says, this edition of the book includes more clarification than expansion of the text material. In addition, several sections of the book are rewritten by adding or modifying the examples.

This book presents the subject of dynamics using the classical laws of physics. The text describes the relationship between the forces acting on a physical object and the motion that is produced by the force system. Although there are many books on the subject, this book should turn out to be one of the popular textbooks in this subject area. As a textbook, it is well-suited for upper level undergraduate or first semester graduate level students as an "Intermediate Dynamics" course. It is also an excellent reference book for practicing engineers and physicists.

This book has 462 pages of text and is thorough and systematic in developing the subject matter of each chapter. In every case, the author gives clear, well chosen examples. The examples and figures presented clearly illustrate the concepts and the results. Each of the chapters concludes with a list of problems to be solved by the reader.

The book starts with a brief introduction of Newton's Laws and the associated energy and momentum principles. The second chapter covers kinematics of a particle. The basic techniques for describing the motion of a particle are explained using various sets of coordinate systems along with examples. The third chapter develops coordinate transformation relationships for position, velocity, and acceleration from fixed and moving reference frames. Several examples are given describing the subject of relative motion.

The next two chapters focus on the kinematics of rigid bodies and the relation of the motion to the force system acting on the body. Chapter Four starts with the definitions of body-fixed reference frames and the Eulerian angles. The kinematical equations describing the interconnections, such as pin connection or ball-and-socket joint, between the bodies are described

next. The kinematical equations covering rolling of one body on the other are included along with some excellent examples. Chapter Five covers Newtonian kinetics of a rigid body. This chapter begins with basic kinetics principles for rigid-body motion followed by evaluation of angular momentum associated with the specified rotation of the body. It includes a brief summary of moments and products of inertia and transformation of inertia properties. The equations of motion and principles of impulse-momentum and work-energy are summarized in the next two sections along with some appropriate examples.

Chapter Six presents principles of analytical mechanisc to the reader. The Lagrangian formulations are introduced in this chapter involving the principles which are based on an overview of the system and its mechanical energy. Lagrange's equations are derived in detail, along with several examples to illustrate their applications. This chapter also briefly describes Hamilton's principle which is useful for the analysis of statically indeterminate structures. Chapter seven continues with further concepts in analytical mechanics. This chapter develops alternative equations of motion. After a detailed explanation of constrained generalized coordinates, Hamilton's equations and Gibbs-Appell equations are derived fully. Several examples are given to illustrate their applications.

Chapter Eight introduces the theory of gyroscopes. The equations of motion governing the rotational motion of a rigid body are described in detail including the classical example of a spinning top. The chapter ends with brief description of use of gyroscopes in the inertial guidance systems.

This book contains an appendix containing formulas for *Centroidal Inertia Properties* for various shapes. It also has answers to even-numbered problems given at the end of each chapter for the reader to solve. Overall, the book is clearly written and provides the kind of detail, examples, and illustrations that will make it an effective textbook.

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