

Preface

Engineering mechanics involves the development of mathematical models of the physical world. Dynamics, a branch of mechanics, addresses the effects of forces on the motion of a body or system of bodies. This book deals with the understanding of the dynamic behavior of engineering structures and components. The tools of formulating the mathematical equations and also the methods of solving the equations are discussed. A knowledge of the motion for the structures and components is most important for their design.

MATLAB[®] is a modern tool that has transformed the mathematical calculations methods because MATLAB not only provides numerical calculations but also facilitates analytical calculations using the computer. This book uses MATLAB as a tool to prove some concepts and to solve problems. The intent is to show the convenience of MATLAB for theory and applications in dynamics. Using example problems, the MATLAB syntax will be demonstrated. MATLAB is very useful in the process of deriving solutions for any problem in dynamics. This book includes a large number of problems that are being solved using MATLAB. Specific functions dealing with dynamic topics are created.

The main distinction of this study from other projects and books is the use of symbolic MATLAB for both theory and applications. Special attention is given to the solutions of the problems that are solved analytically and numerically using MATLAB. The figures generated with MATLAB reinforce visual learning for students as they study the programs.

This book provides a thorough, rigorous presentation of kinematics and dynamics, augmented with proven learning techniques for the benefit of instructor and student. Our first objective is to present the topics thoroughly and directly, allowing fundamental principles to emerge through applications. We emphasize concepts, derivations, and interpretations of the general principles.

Modern technical advancements in areas of multibody systems, robotics, spacecraft, and design of complex mechanical devices and mechanisms in industry need knowledge of solving advanced dynamic concepts. We discussed the tools of formulating the mathematical equations and also the methods of solving them using

a modern computing tool like MATLAB. Included are analytical and numerical methods for explaining the dynamics problems using computer programs.

This book is extremely useful for a number of reasons. This book presents theory, computational aspects, and applications of dynamical systems and is a straightforward introduction to the subject. It provides coverage of basic material with both mathematical and physical. This book will assist the graduate students interested in the classical principles of dynamical systems and is used primarily for a one semester course in dynamics. This book can be used for classroom instruction, and it can be used for a self-study and can also be offered as distance learning. It would be appropriate for use as a text for senior undergraduate and first year graduate students.

This text is based on MATLAB Version 7.12 (R2011a) and requires the use of the Symbolic Math ToolboxTM.

The MATLAB programs for the solved examples are found on Springer Extras at <http://extras.springer.com/andathhttp://www.eng.auburn.edu/~marghitu/>.