

**Dankowicz, Harry**

**Multibody mechanics and visualization.** (English) Zbl 1077.70001  
London: Springer (ISBN 1-85233-799-0/hbk). xviii, 504 p. (2005).

This book differs from traditional mechanics textbooks. Instead of offering a necessary backdrop for the professional development of an engineering sciences or mechanical engineering student interested in solving mechanical problems, the author develops here a course that relies on the concept of problem-based learning. It allows the student to accumulate theoretical knowledge, develop intuitive insights into and perfect a practical know-how in the modelling and visualization of complex mechanical systems and their motion. This approach should generate much interest for computer-savvy students, who want to acquire more general skills in mathematical and physical modelling of mechanical systems, more than just problem solving skills, in order to produce attractive computer simulation and animation programs.

The instructional objectives are to prepare the student to: model the kinematics and dynamics of an arbitrary multibody mechanism; formulate a mathematical description of a general motion of this mechanism in terms of sets of descriptive variables and systems of differential equations governing their evolution; implement this description in a computer-graphics application for animating and visualizing a desired or observed motion of the mechanism.

For the development of the course material, the author observed pedagogical principles that appeal to the educational background, interests, and perspectives of a modern engineering student, namely: an inductive approach to learning, whereby general patterns are discerned from observations made in particular instances; a need for repetition and review of important concepts and their reinforcement through numerical examples; visual guidance to allow the student to differentiate between different levels of knowledge; deep incorporation of computer tools, visual representations, and elements of active learning to appeal to a broad spectrum of learning strategies and preferences.

Parallel to the theoretical presentations, the book includes a series of computer-algebra procedures for enabling advanced computations for complex multibody mechanism. This package, the MAMBO toolbox, is based on a set of procedures written in the MAPLE programming language and is compatible with MAPLE V and later versions, as well as with MATLAB's extended symbolic toolbox. The computer-graphics application MAMBO allows the students to check the mathematical analysis and to visualize the results of their efforts by displaying the implications of decisions made throughout the modelling stages.

A worthwhile feature of this book is the recommendation of various animation and modelling projects for semester long team assignments with an outline of a specific project presentation structure. The examples illustrate the complexity of the multibody mechanics and visualization projects for which MAMBO is useful to define the specific geometry of the mechanism and the differential equations governing its behaviour. Earlier versions of this textbook have been used as course literature for sophomore level, senior level, and beginning graduate level courses on multibody mechanisms and visualizations, offered by the author at Virginia Polytechnic Institute and State University in Blacksburg, Virginia, USA, and at the Royal Institute of Technology in Stockholm, Sweden. This excellent research exposition deserves a wide distribution and acceptance.

Reviewer: [Franz Selig \(Wien\)](#)

#### MSC:

- 70-02 Research exposition (monographs, survey articles) pertaining to mechanics of particles and systems
- 70E55 Dynamics of multibody systems
- 70-08 Computational methods for problems pertaining to mechanics of particles and systems
- 68U05 Computer graphics; computational geometry (digital and algorithmic aspects)
- 68U20 Simulation (MSC2010)
- 68W30 Symbolic computation and algebraic computation

**Keywords:**

computer simulation; complex multibody mechanisms; MAMBO

**Software:**

MAMBO; Maple; Matlab