

# Preface

As the name suggests, a multibody system is an assembly of several bodies connected to each other by joints and acted upon by forces. A body, which can be rigid or flexible, is composed of a collection of material points. A joint allows for certain degrees of freedom and constrains others. In practice, joints are connection devices such as bearings, rod guides, etc., which from a mathematical point of view are denominated as revolute joints, translational joints, etc., according to the relative degrees of motion permitted. The forces can have different sources and different levels of complexity. Dynamics of multibody systems is based on classical mechanics and has a long and prolific history. Multibody systems serve as a basis for many models of mechanical systems and have been applied in many areas of science and engineering. Multibody systems are often used to analyze biological and human locomotion. Controlled systems are frequently prototyped through computer simulation of multibody models. There are also applications in medical, robotics, space subsystems, and computer games. A free or unconstrained material point is the simplest multibody system that can be studied by applying the equations of motion established with genial acumen by Newton. In turn, D'Alembert considered a system of constrained rigid bodies, in which the distinction between the applied and reaction forces was established. A systematic analysis of constrained multibody systems was developed by Lagrange. However, it was only during the last half of the century that multibody dynamics received conspicuous attention thanks to the impressive computer progresses verified at both software and hardware levels. As a consequence, a great variety of methodologies have been proposed, despite the fact that all of them can be derived from a few fundamental principles of mechanics. The main purpose of this work is to present, in a review manner, the fundamental concepts and formulations for spatial multibody dynamics. The following material does not claim for completeness nor it is designed to substitute a textbook. It provides the reader with the basis background on the issue of spatial multibody dynamics and it might be helpful for understanding the methodologies and approaches offered in the present work.

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Concepts and Formulations for Spatial Multibody  
Dynamics

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2015, VIII, 83 p. 36 illus., 1 illus. in color., Softcover

ISBN: 978-3-319-16189-1