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Book Reviews

1 Rigid Body Dynamics of Mechanisms. 1 Theoretical Basis. By Hahn, H., Universität GH, Kassel, Germany, Springer-Verlag, 354 pages, Hardcover, ISBN: 3-540-42373-7, Recommended Retail Price: EUR 89,95, Publication date: 01.03.2002

This is an introductory book into basic mechanical aspects of mechatronic systems for students, researchers and engineers.

More specifically in chapter 1 an introduction to the subject of the book is given. More precisely, a definition of a rigid-body is given and it is mentioned that the mechanical systems are collections of rigid-bodies. Also, tasks in multibody simulation, analysis, and control are presented, the coordinates and frames are described, and the formulation of the model equations is presented. Prototype applications of rigid-body mechanisms are described and a general-purpose rigid-body analysis program is presented (Design of an engineering model and input and output data). Finally, a detailed purpose of this monograph is given.

In Chapter 2 a refresh of basic concepts of vector algebra and vector analysis is given (Planar vectors and matrices, elementary vector and matrix operations (Geometric vectors, Algebraic vectors), Time derivatives of displacement vectors and orientation matrices (Velocities and angular velocities, Accelerations and angular accelerations), spatial vectors and matrices (Displacement vectors, frames, and orientation matrices (Basis transformation, Coordinate transformation, Bryant angles), Time derivatives of displacement vectors and orientation matrices (Velocities and angular velocities, Accelerations and angular accelerations, kinematic differential equation)

In Chapter 3 an introduction to constraint equations and constraint reaction forces of mechanisms is given. More specifically, an introduction to kinematics of planar and spatial rigid-body systems is presented (Kinematics of planar mechanisms, (Pure kinematic analysis of planar mechanisms, Regular and singular planar kinematics, kinematics in planar dynamic analysis), Kinematics of spatial mechanisms (Pure kinematic analysis of spatial mechanisms, kinematics in spatial dynamic analysis), Singularity analysis of a planar slider-crank mechanism (Identification of singularities by direct inspection, local algebraic singularity analysis of the slider crank mechanism). Finally an introduction to constraint reaction forces and torques of mechanisms is also described (Constraint reaction forces of planar mechanisms, Constraint reaction forces of spatial mechanisms).

In Chapter 4 the equations of spatial and planar motion of unconstrained rigid bodies are derived based on the laws of Newton and Euler. In section 4.1 an introduction to linear momentum and angular momentum of a rigid body is presented (Linear momentum, Angular momentum, Properties of the inertia matrix (Physical interpretation of , Time dependence of and , Steiner-Huygens relation). In section 4.2 the Newton-Euler equations of an unconstrained rigid body are produced (Force moments and couples, Newton's law, Euler's law, Newton-Euler equations of a rigid body under planar and spatial motion (Spatial motion, Planar motion). In section 4.3 the

equations of motion of planar and spatial rigid-body mechanisms are presented (Equations of planar motion of unconstrained rigid bodies in DE form and of constrained rigid-body systems in DAE (differential-algrebraic equation) form (A single unconstrained rigid body, system of unconstrained rigid bodies, a single rigid body constrained with respect to the base, system of constrained rigid bodies), equations of spatial motion of unconstrained rigid bodies in DE form and of constrained rigid-body mechanisms in DAE form (A single unconstrained rigid body, system of unconstrained rigid bodies, a single rigid body constrained with respect to the base, system of constrained rigid bodies). Finally in section 4.4 an introduction to the numerical solution of DAEs is presented (Ideal situation (Algebraic aspects, numerical integration step), more realistic situations (Singular matrix A, constraint violation).

In Chapter 5 a detailed approach for production of the constraint equations of planar and spatial joints is presented. In this section the derivation of constraint equations of various types is presented. More specifically the derivation of theoretical models of planar joints is presented in section 5.1 (Absolute constrains, relative planar joints between two bodies, pseudo-joint and force/torque elements). Theoretical modeling of spatial joints is presented in section 5.2 (Building blocks of joint models, theoretical models of common joints).

In Chapter 6 constitutive relations of planar and spatial external forces and torques are investigated (Constitutive relations of planar external forces and torques, constitutive relations of spatial external forces and torques).

Finally, in appendices we have the presentation of some additional material which is very useful for the readers of the book. More specifically, special vector and matrix operations used in mechanics, Lagrange formalism of a rigid body under spatial motion, model equations of planar and spatial mechanisms and constrained equations of a general universal joint are presented.

The present book is a very important and useful introduction of mechanical aspects of mechatronic systems. This book is very useful for undergraduate students of mechanical engineering, control engineering, civil engineering, electrical engineering, mathematics and physics. This book is also very useful for practicing engineers since with this book they have the opportunity of a systematic choice of notation, of an algebraic formulation of all the expressions, of a possibility of direct implementation in a computer and finally of an application of these methods to both simple and complex problems.

T.E. Simos,
University of Peloponnese, Tripolis,
Greece

2 High-Energy Particle Diffraction, by Barone, V., Universita del Piemonte Orientale and INFN, Alessandria, Italy; Predazzi, E., Universita di Torino and INFN, Turine, Italy, Springer-Verlag, 420 pages, 188 figures, Hardcover , ISBN: 3-540-42107-6, Recommended Retail Price: EUR 74,95. Publication date: 26.02.2002

The purpose of the present book is to present the main insights which have mentioned the growth of high-energy diffractive physics in recent decades and also to present the recent state of the art.

The book is divided into three main parts.

In the first part (Chapters 1-3) an introduction in the field is presented. More specifically in Chapter 1 an Introduction to Diffractive Phenomena is presented and a Brief Historical Survey is described. In Chapter 2 some preliminaries are presented. In more details, an introduction to optics

is presented (Kirchhoff Theory, Fraunhofer Diffraction, Cross-sections, Examples, Scattering of Light by a Sphere). A potential scattering introduction is also discussed (The Schrödinger Equation Approach, Partial Wave Expansion, The S-Matrix Approach, Born Approximation, Central Fields). Finally, an eikonal approximation is also described. In Chapter 3 an introduction to kinematics is also presented. More specifically the scattering processes are discussed, two-body processes are investigated (Mandelstam Variables, The Center-of-Mass System, The Laboratory System, Physical Domains of the s, u and t Channels) and finally single-inclusive processes are also described (Feynman's Variable, Rapidity and Rapidity Gaps, Diffractive Dissociation).

In the second part (Chapters 4-7) the main developments in the diffraction the past decades are presented. The description is presented with an emphasis on the theoretical and experimental results which are still of some importance. More specifically in Chapter 4 the S-Matrix properties are presented (General Definitions, Scattering Amplitudes and Cross-sections, unitarity (The Optical Theorem, Other Consequences of Unitarity, Elastic Unitarity), Analyticity, Crossing, Dispersion Relations, The Froissart-Gribov Representation, Mueller's Generalized Optical Theorem, Rigorous Theorems (The Froissart-Martin Bound, The Pomeranchuk Theorems). In Chapter 5 the Regge Theory is presented (The Regge Pole Idea, Meson Exchange vs. Reggeon Exchange, Convergence of the Partial-Wave Expansion, Complex Angular Momenta, Regge Poles in Quantum Mechanics, Regge Poles in Relativistic Scattering, Regge Trajectories, Regge Phenomenology, Regge Poles in Field Theory, Regge Cuts). In Chapter 6 the s-Channel Models are described (The Eikonal Picture, A Model for the Eikonal Amplitude, The Structure of Hadrons in the Impact-Parameter Space, s-Channel Models, Duality, The Veneziano Model). Finally, in Chapter 7the phenomenology of soft diffraction is presented (Total Cross-sections, The Real Part of the Forward Elastic Amplitude, Elastic Cross-sections, The Dip-Shoulder Region, Diffractive Dissociation, Soft Diffraction at RHIC and LHC).

Finally, in the third part (Chapters 8-11) the main new developments in the diffraction are presented. More specifically in Chapter 8 a discussion on The pomeron in perturbative QCD is presented (Early Approaches, The Perturbative QCD Pomeron, Quark-Quark Scattering in Leading ln s Approximation, The BFKL Equation, Color-Octet Exchange, Color-Singlet Exchange, Solution of the BFKL Equation for , Parton-Parton Scattering: Total Cross-sections, Diffusion, Running Coupling, Soft vs. Hard Pomeron, Non-perturbative Effects, The Perturbative QCD Odderon, Solution of the BFKL Equation for , Parton-Parton Elastic Scattering, Hadron-Hadron Scattering, The BFKL Pomeron at Next-to-Leading Order). In Chapter 9 the Deep Inelastic Scattering Theory is presented (Kinematics, Parton Model, Structure Functions in QCD, Phenomenology of DIS, DIS at Low-, The BFKL Equation in DIS, The CCFM Equation, Gluon Recombination Effects, The Color Dipole Picture of DIS, The BFKL Equation in the Color Dipole Formalism, Unitarization of Structure Functions in the Color Dipole Approach). In Chapter 10 the diffractive hadron-hadron processes are investigated phenomenologically (Diffractive Deep Inelastic Scattering, Kinematics of DDIS, Diffractive Structure Functions, Diffractive Parton Distributions, Regge Theory of DDIS, The Partonic Structure of the Pomeron, Experimental Signatures of DDIS, Measurements of , Hardonic Final States in DDIS, Vector Meson Production, Diffraction in Hadron-Hadron Collisions). Finally in Chapter 11 the hard diffraction in QCD is presented (Quantum Mechanics of Diffractive Scattering, Diffractive DIS in the Impact-Parameter Representation, The Spectrum of DDIS: a Preliminary Evaluation, Diffractive Cross-sections in the Two-Gluon Exchange Approximation, Jets in Diffractive DIS, Diffractive Production of Open Charm, Diffractive Vector Meson Production at , Other QCD Approaches to DDIS, Nuclear Shadowing and Diffractive Dissociation, Dipole Scattering, The Total Cross-section, Diffractive Photoproduction at High , BFKL Dynamics in High-Jet Production).

We mention here that in Appendix A some conventions and definitions of general use and interest are discussed. In Appendix B the Mellin Transforms are presented. Finally in Appendix C the QCD Formulas are described.

This monograph is a very high quality up-to-date review of soft and hard diffraction processes in strong interaction physics. We can divide this very interesting book into two parts. The first part covers the Chapters 1-7 and can be used as a textbook in particle physics classes. The second part covers the Chapters 8-11 and can be used by graduate students as well as researchers. I think that this book is useful for every particle physicist.

T.E. Simos,
University of Peloponnese, Tripolis,
Greece