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Mathematical Foundation of Railroad Vehicle Systems -

Ahmed A. Shabana 2021-01-26

MASTER AND INTEGRATE
THE GEOMETRY AND
MECHANICS OF RAILROAD
VEHICLE SYSTEM

ENGINEERING WITH ONE
PRACTICAL RESOURCE

Mathematical Foundation of Railroad Vehicle Systems: Geometry and Mechanics delivers a comprehensive treatment of the mathematical foundations of railroad vehicle systems. The book includes a strong emphasis on the integration of geometry and mechanics to create an accurate and accessible formulation of nonlinear dynamic equations and general computational algorithms that can be effectively used in the virtual prototyping, analysis, design, and performance evaluation of railroad vehicle systems. Using basic concepts, formulations, and computational algorithms,

including mechanics-based approaches like the absolute nodal coordinate formulation (ANCF), readers will understand how to integrate the geometry and mechanics of railroad vehicle systems. The book also discusses new problems and issues in this area and describes how geometric and mechanical approaches can be used in derailment investigations. Mathematical Foundation of Railroad Vehicle Systems covers: The mathematical foundation of railroad vehicle systems through the integration of geometry and mechanics Basic concepts, formulations, and computational algorithms used in railroad vehicle system dynamics New mechanics-based approaches, like the ANCF, and their use to achieve an integration of geometry and mechanics Use of geometry and mechanics to study derailments New problems and

issues in the area of railroad vehicle systems Designed for researchers and practicing engineers who work with railroad vehicle systems, *Mathematical Foundation of Railroad Vehicle Systems: Geometry and Mechanics* can also be used in senior undergraduate and graduate mechanical, civil, and electrical engineering programs and courses.

Miscellaneous Publication - National Bureau of Standards - United States. National Bureau of Standards 1934

Ground Vehicle Dynamics - Karl Popp 2010-03-16
Ground Vehicle Dynamics is devoted to the mathematical modelling and dynamical analysis of ground vehicle systems composed of the vehicle body, the guidance and suspension devices and the corresponding guideway. Automobiles on uneven roads and railways on flexible tracks are prominent representatives of ground vehicle systems. All these different kinds of systems

are treated in a common way by means of analytical dynamics and control theory. In addition to a detailed modelling of vehicles as multibody systems, the contact theory for rolling wheels and the modelling of guideways by finite element systems as well as stochastic processes are presented. As a particular result of this integrated approach the state equations of the global systems are obtained including the complete interactions between the subsystems considered as independent modules. The fundamentals of vehicle dynamics for longitudinal, lateral and vertical motions and vibrations of automobiles and railways are discussed in detail.

Vehicle Dynamics - Reza N. Jazar 2013-11-19

This textbook is appropriate for senior undergraduate and first year graduate students in mechanical and automotive engineering. The contents in this book are presented at a theoretical-practical level. It explains vehicle dynamics

concepts in detail, concentrating on their practical use. Related theorems and formal proofs are provided, as are real-life applications. Students, researchers and practicing engineers alike will appreciate the user-friendly presentation of a wealth of topics, most notably steering, handling, ride, and related components. This book also: Illustrates all key concepts with examples Includes exercises for each chapter Covers front, rear, and four wheel steering systems, as well as the advantages and disadvantages of different steering schemes Includes an emphasis on design throughout the text, which provides a practical, hands-on approach

Essentials of Vehicle

Dynamics - Joop Pauwelussen
2014-10-18

Essentials of Vehicle Dynamics explains the essential mathematical basis of vehicle dynamics in a concise and clear way, providing engineers and students with the qualitative understanding of vehicle handling performance needed

to underpin chassis-related research and development. Without a sound understanding of the mathematical tools and principles underlying the complex models in vehicle dynamics, engineers can end up with errors in their analyses and assumptions, leading to costly mistakes in design and virtual prototyping activities. Author Joop P. Pauwelussen looks to rectify this by drawing on his 15 years' experience of helping students and professionals understand the vehicle as a dynamic system. He begins as simply as possible before moving on to tackle models of increasing complexity, emphasizing the critical role played by tire-road contact and the different analysis tools required to consider non-linear dynamical systems. Providing a basic mathematical background that is ideal for students or those with practical experience who are struggling with the theory, Essentials of Vehicle Dynamics is also intended to help engineers from different disciplines, such as control and

electronic engineering, move into the automotive sector or undertake multi-disciplinary vehicle dynamics work.

Focuses on the underlying mathematical fundamentals of vehicle dynamics, equipping engineers and students to grasp and apply more complex concepts with ease. Written to help engineers avoid the costly errors in design and simulation brought about by incomplete understanding of modeling tools and approaches. Includes exercises to help readers test their qualitative understanding and explain results in physical and vehicle dynamics terms.

Road and Off-Road Vehicle System Dynamics Handbook - Gianpiero Mastinu 2014-01-06

Featuring contributions from leading experts, the Road and Off-Road Vehicle System Dynamics Handbook provides comprehensive, authoritative coverage of all the major issues involved in road vehicle dynamic behavior. While the focus is on automobiles, this book also highlights motorcycles, heavy commercial vehicles, and off-road

vehicles. The authors
Recent Advances in Technology Research and Education - Dumitru Luca 2017-09-08

This book presents selected contributions to the 16th International Conference on Global Research and Education Inter-Academia 2017 hosted by Alexandru Ioan Cuza University of Iași, Romania from 25 to 28 September 2017. It is the third volume in the series, following the editions from 2015 and 2016. Fundamental and applied research in natural sciences have led to crucial developments in the ongoing 4th global industrial revolution, in the course of which information technology has become deeply embedded in industrial management, research and innovation - and just as deeply in education and everyday life. Materials science and nanotechnology, plasma and solid state physics, photonics, electrical and electronic engineering, robotics and metrology, signal processing, e-learning, intelligent and soft computing have long since been central

research priorities for the Inter-Academia Community (I-AC) - a body comprising 14 universities and research institutes from Japan and Central/East-European countries that agreed, in 2002, to coordinate their research and education programs so as to better address today's challenges. The book is intended for use in academic, government, and industrial R&D departments as a reference tool in research and technology education. The 42 peer-reviewed papers were written by more than 119 leading scientists from 14 countries, most of them affiliated to the I-AC.

Dynamical Analysis of Vehicle Systems - W. Schiehlen
2009-05-21

This volume presents an integrated approach of the common fundamentals of rail and road vehicles based on multibody system dynamics, rolling wheel contact and control system design. The methods presented allow an efficient and reliable analysis of the resulting state

equations. The book provides also a better understanding of the basic physical phenomena of vehicle dynamics. Particular attention is paid to developments of future rail and road vehicles including motorcycles.

The Multibody Systems Approach to Vehicle Dynamics
- Michael Blundell 2014

Filling the gaps between subjective vehicle assessment, classical vehicle dynamics and computer-based multibody approaches, *The Multibody Systems Approach to Vehicle Dynamics* offers unique coverage of both the virtual and practical aspects of vehicle dynamics from concept design to system analysis and handling development. The book provides valuable foundation knowledge of vehicle dynamics as well as drawing on laboratory studies, test-track work, and finished vehicle applications to gel theory with practical examples and observations. Combined with insights into the capabilities and limitations of multibody simulation, this

comprehensive mix provides the background understanding, practical reality and simulation know-how needed to make and interpret useful models. New to this edition you will find coverage of the latest tire models, changes to the modeling of light commercial vehicles, developments in active safety systems, torque vectoring, and examples in AView, as well as updates to theory, simulation, and modeling techniques throughout. Unique gelling of foundational theory, research findings, practical insights, and multibody systems modeling know-how, reflecting the mixed academic and industrial experience of this expert author team Coverage of the latest models, safety developments, simulation methods, and features bring the new edition up to date with advances in this critical and evolving field

Dynamic Stability of Space Vehicles: Shell dynamics with special applications to control problems, by L. E. Penzes - General Dynamics Corporation

1968

Vehicle Dynamics - Rao V. Dukkipati 2000

Growing worldwide populations increasingly require faster, safer, and more efficient transportation systems. These needs have led to a renewed interest in high-speed guided ground transportation technology, inspired considerable research, and instigated the development of better analytical and experimental tools. A very significant body of knowledge currently exists, but has primarily remained scattered throughout the literature. *Vehicle Dynamics* consolidates information from a wide spectrum of sources in the area of guided ground transportation. Each chapter provides a concise, thorough statement of the fundamental theory, followed by illustrative worked examples and exercises. The author also includes a variety of unsolved problems designed to amplify and extend the theory and provide problem-solving

experience. The subject of guided ground transportation is vast, but this book brings together the core topics, providing in-depth treatments of topics ranging from system classification, analysis, and response to landing dynamics and rail, air cushion, and maglev systems. In doing so, Vehicle Dynamics offers a singular opportunity for readers to build the solid background needed for solving practical vehicle dynamics problems or pursuing more advanced or specialized studies.

Computational Dynamics -

Ahmed A. Shabana 2009-11-06
Computational Dynamics, 3rd edition, thoroughly revised and updated, provides logical coverage of both theory and numerical computation techniques for practical applications. The author introduces students to this advanced topic covering the concepts, definitions and techniques used in multi-body system dynamics including essential coverage of kinematics and dynamics of

motion in three dimensions. He uses analytical tools including Lagrangian and Hamiltonian methods as well as Newton-Euler Equations. An educational version of multibody computer code is now included in this new edition

www.wiley.com/go/shabana that can be used for instruction and demonstration of the theories and formulations presented in the book, and a new chapter is included to explain the use of this code in solving practical engineering problems. Most books treat the subject of dynamics from an analytical point of view, focusing on the techniques for analyzing the problems presented. This book is exceptional in that it covers the practical computational methods used to solve "real-world" problems. This makes it of particular interest not only for senior/ graduate courses in mechanical and aerospace engineering, but also to professional engineers. Modern and focused treatment of the mathematical techniques,

physical theories and application of rigid body mechanics that emphasizes the fundamentals of the subject, stresses the importance of computational methods and offers a wide variety of examples. Each chapter features simple examples that show the main ideas and procedures, as well as straightforward problem sets that facilitate learning and help readers build problem-solving skills

Stability Analysis and Control of Powertrain for New Energy Vehicles -

Donghai Hu 2021-10-15

This book introduces the application of nonlinear dynamics theory for driving system of electric vehicle and hybrid electric vehicle respectively. It establishes the dynamic models for driving system of electric vehicle and hybrid electric vehicle under various working conditions. And the nonlinear dynamics theory is applied to the qualitative analysis and quantitative calculation for the models. The theoretical

analysis results are applied to guide the optimization of control strategies. In the end of each chapter, corresponding simulations or experiments are provided to verify the corresponding instances which are carefully selected. This book will give some guidance to readers when they deal with nonlinear dynamics problems of vehicles in the future and provide theoretical bases for the further study of the nonlinear dynamics for driving system of electric vehicle and hybrid electric vehicle. The book is written for engineer of electric vehicle and hybrid vehicle, teachers and students majoring in automobile and automation.

Control Applications of Vehicle Dynamics - Jingsheng Yu 2021-12-20

This book presents essential knowledge of car vehicle dynamics and control theory with NI LabVIEW software product application, resulting in a practical yet highly technical guide for designing advanced vehicle dynamics and vehicle system controllers.

Presenting a clear overview of fundamental vehicle dynamics and vehicle system mathematical models, the book covers linear and non-linear design of model based controls such as wheel slip control, vehicle speed control, path following control, vehicle stability and rollover control, stabilization of vehicle-trailer system. Specific applications to autonomous vehicles are described among the methods. It details the practical applications of Kalman-Bucy filtering and the observer design for sensor signal estimation, alongside lateral vehicle dynamics and vehicle rollover dynamics. The book also discusses high level controllers, alongside a clear explanation of basic control principles for regenerative braking in both electric and hybrid vehicles, and wheel torque vectoring systems. Concrete LabVIEW simulation examples of how the models and controls are used in representative applications, along with software algorithms and LabVIEW block diagrams

are illustrated. It will be of interest to engineering students, automotive engineering students and automotive engineers and researchers.

Rail Vehicle Mechatronics - Maksym Spiryagin 2021-12-09

This unique and up-to-date work surveys the use of mechatronics in rail vehicles, notably traction, braking, communications, data sharing, and control. The results include improved safety, comfort, and fuel efficiency. Mechatronic systems are a key element in modern rail vehicle design and operation. Starting with an overview of mechatronic theory, the book goes on to cover topics including modeling of mechanical and electrical systems for rail vehicles, open and closed loop control systems, sensors, actuators and microprocessors. Modern simulation techniques and examples are included throughout, and numerical experiments and developed models for railway application are presented and explained. Case studies are used,

alongside practical examples, to ensure that the reader can apply mechatronic theory to real world conditions. These case studies include modeling of a hybrid locomotive and simplified models of railway vehicle lateral dynamics for suspension control studies. Rail Vehicle Mechatronics provides current and in-depth content for design engineers, operations managers, systems engineers and technical consultants world-wide, working with freight, passenger, and urban transit railway systems.

Research and Technology Program Digest - United States. National Aeronautics and Space Administration

Systems Engineering in Ceramics - 1965

Proceedings of the International Conference on Advances in Computational Mechanics 2017 - Hung Nguyen-Xuan 2018-02-20

This book provides an overview of state-of-the-art methods in computational engineering for

modeling and simulation. This proceedings volume includes a selection of refereed papers presented at the International Conference on Advances in Computational Mechanics (ACOME) 2017, which took place on Phu Quoc Island, Vietnam on August 2-4, 2017. The contributions highlight recent advances in and innovative applications of computational mechanics. Subjects covered include: biological systems; damage, fracture and failure; flow problems; multiscale multiphysics problems; composites and hybrid structures; optimization and inverse problems; lightweight structures; computational mechatronics; computational dynamics; numerical methods; and high-performance computing. The book is intended for academics, including graduate students and experienced researchers interested in state-of-the-art computational methods for solving challenging problems in engineering.

Handbook of Railway Vehicle

Dynamics, Second Edition - Simon Iwnicki 2019-11-14
Handbook of Railway Vehicle Dynamics, Second Edition, provides expanded, fully updated coverage of railway vehicle dynamics. With chapters by international experts, this work surveys the main areas of rolling stock and locomotive dynamics. Through mathematical analysis and numerous practical examples, it builds a deep understanding of the wheel-rail interface, suspension and suspension component design, simulation and testing of electrical and mechanical systems, and interaction with the surrounding infrastructure, and noise and vibration. Topics added in the Second Edition include magnetic levitation, rail vehicle aerodynamics, and advances in traction and braking for full trains and individual vehicles.

Multibody Systems Approach to Vehicle Dynamics - Michael Blundell 2004

Comprehensive, up-to-date and firmly rooted in practical experience, a key publication

for all automotive engineers, dynamicists and students.

Computers in Railways XIV - C. A. Brebbia 2014-06-01

This book contains the 14th proceedings of the, very successful, International conference on Railway Engineering Design and Optimization (COMPRAIL 2014), which began in 1987.

Advanced Autonomous Vehicle Design for Severe Environments - V.V. Vantsevich 2015-10-20

Classical vehicle dynamics, which is the basis for manned ground vehicle design, has exhausted its potential for providing novel design concepts to a large degree. At the same time, unmanned ground vehicle (UGV) dynamics is still in its infancy and is currently being developed using general analytical dynamics principles with very little input from actual vehicle dynamics theory. This technical book presents outcomes from the NATO Advanced Study Institute (ASI) 'Advanced Autonomous Vehicle Design for Severe Environments', held in

Coventry, UK, in July 2014. The ASI provided a platform for world class professionals to meet and discuss leading-edge research, engineering accomplishments and future trends in manned and unmanned ground vehicle dynamics, terrain mobility and energy efficiency. The outcomes of this collective effort serve as an analytical foundation for autonomous vehicle design. Topics covered include: historical aspects, pivotal accomplishments and the analysis of future trends in on- and off-road manned and unmanned vehicle dynamics; terramechanics, soil dynamic characteristics, uncertainties and stochastic characteristics of vehicle-environment interaction for agile vehicle dynamics modeling; new methods and techniques in on-line control and learning for vehicle autonomy; fundamentals of agility and severe environments; mechatronics and cyber-physics issues of agile vehicle dynamics to design for control, energy harvesting and cyber

security; and case studies of agile and inverse vehicle dynamics and vehicle systems design, including optimisation of suspension and driveline systems. The book targets graduate students, who desire to advance further in leading-edge vehicle dynamics topics in manned and unmanned ground vehicles, PhD students continuing their research work and building advanced curricula in academia and industry, and researchers in government agencies and private companies.

NASA technical note - 1973

Fundamentals of Vehicle Dynamics - Thomas Gillespie 1992-02-01

This book attempts to find a middle ground by balancing engineering principles and equations of use to every automotive engineer with practical explanations of the mechanics involved, so that those without a formal engineering degree can still comprehend and use most of the principles discussed. Either as an introductory text or a

practical professional overview, this book is an ideal reference.

Dynamic Stability of Space Vehicles - General Dynamics Corporation 1967

Archives of Mechanics - 2006

Applied Mechanics Reviews - 1974

Advances in Dynamical Systems Theory, Models, Algorithms and Applications

- Bruno Carpentieri 2021-07-28

The theory of modern dynamical systems dates back to 1890 with studies by Poincaré on celestial mechanics. The tradition was continued by Birkhoff in the United States with his pivotal work on periodic orbits, and by the Moscow School in Russia (Liapunov, Andronov, Pontryagin). In the 1960s the field was revived by the emergence of the theory of chaotic attractors, and in modern years by accurate computer simulations. This book provides an overview of recent developments in the

theory of dynamical systems, presenting some significant advances in the definition of new models, computer algorithms, and applications. Researchers, engineers and graduate students in both pure and applied mathematics will benefit from the chapters collected in this volume.

National Bureau of Standards Miscellaneous Publication - 1964

Guide to Load Analysis for Durability in Vehicle

Engineering - P. Johannesson 2013-08-29

The overall goal of vehicle design is to make a robust and reliable product that meets the demands of the customers and this book treats the topic of analysing and describing customer loads with respect to durability. Guide to Load Analysis for Vehicle and Durability Engineering supplies a variety of methods for load analysis and also explains their proper use in view of the vehicle design process. In Part I, Overview, there are two chapters presenting the scope

of the book as well as providing an introduction to the subject. Part II, Methods for Load Analysis, describes useful methods and indicates how and when they should be used. Part III, Load Analysis in view of the Vehicle Design Process, offers strategies for the evaluation of customer loads, in particular characterization of customer populations, which leads to the derivation of design loads, and finally to the verification of systems and components. Key features:

- Is a comprehensive collection of methods for load analysis, vehicle dynamics and statistics
- Combines standard load data analysis methods with statistical aspects on deriving test loads from surveys of customer usage
- Sets the methods used in the framework of system dynamics and response, and derives recommendations for the application of methods in engineering practice
- Presents a reliability design methodology based on statistical evaluation of component strength and customers loads
- Includes

case studies and illustrative examples that translate the theory into engineering practice Developed in cooperation with six European truck manufacturers (DAF, Daimler, Iveco, MAN, Scania and Volvo) to meet the needs of industry, Guide to Load Analysis for Vehicle and Durability Engineering provides an understanding of the current methods in load analysis and will inspire the incorporation of new techniques in the design and test processes.

Systems Engineering in Ceramics - American Ceramic Society 1965

Proceedings of the 1st International Workshop on High-Speed and Intercity Railways - Yi-Qing Ni
2012-02-13

This book contains the papers included in the proceedings of the 1st International Workshop on High-speed and Intercity Railways (IWHIR 2011) held in Shenzhen and Hong Kong, China from July 19 to July 22, 2011, which is organized by

The Hong Kong Polytechnic University, in collaboration with Southwest Jiaotong University, Beijing Jiaotong University, Dalian Jiaotong University, China Engineering Consultants, Inc., Zhejiang University, and Tsinghua University. Continuing the great initiatives and momentums of the rapid development in high-speed and intercity railways worldwide in recent years, IWHIR 2011 aims at providing a platform for academic scholars and practicing engineers to share knowledge and experience, to promote collaboration, and to strengthen R&D activities related to railway engineering. Engineers, scientists, professors, and students from universities, research institutes, and related industrial companies have been cordially invited to participate in the workshop. These papers have covered a wide range of issues concerning high-speed and intercity railways in the theoretical, numerical, and experimental work pertaining to high-speed and intercity

railways. Showcasing diversity and quality, these papers report the state-of-the-art and point to future directions of research and development in this exciting area.

Transdisciplinary Engineering: Crossing Boundaries - M. Borsato
2016-10-13

The Concurrent Engineering (CE) approach was developed in the 1980s, based on the concept that different phases of a product life cycle should be conducted concurrently and initiated as early as possible within the Product Creation Process (PCP). CE concepts have matured and become the foundation of many new ideas, methodologies, initiatives, approaches and tools. This book contains the proceedings from the 23rd ISPE Inc. International Conference on Transdisciplinary (formerly: Concurrent) Engineering, held in Curitiba, Parana, Brazil, in October 2016. The conference, entitled 'Transdisciplinary Engineering: Crossing Boundaries', provides an important forum for

international scientific exchange on Concurrent Engineering and collaborative enterprises, and attracts the participation of researchers, industry experts and students, as well as government representatives. The 108 peer reviewed papers and keynote speech included here, range from theoretical and conceptual to strongly pragmatic works, which are organized into 17 sections including: Concurrent Engineering and knowledge exchange; engineering for sustainability; multidisciplinary project management; collaborative design and engineering; optimization of engineering operations and data analytics; and multidisciplinary design optimization, among others. The book gives an overview of the latest research, advancements and applications in the field and will be of interest to researchers, design practitioners and educators.

Dynamics of Vehicle-Road Coupled System - Shaopu Yang 2015-05-13

Vehicle dynamics and road dynamics are usually considered to be two largely independent subjects. In vehicle dynamics, road surface roughness is generally regarded as random excitation of the vehicle, while in road dynamics, the vehicle is generally regarded as a moving load acting on the pavement. This book suggests a new research concept to integrate the vehicle and the road system with the help of a tire model, and establishes a cross-subject research framework dubbed vehicle-pavement coupled system dynamics. In this context, the dynamics of the vehicle, road and the vehicle-road coupled system are investigated by means of theoretical analysis, numerical simulations and field tests. This book will be a valuable resource for university professors, graduate students and engineers majoring in automotive design, mechanical engineering, highway engineering and other related areas. Shaopu Yang is a professor and deputy president

of Shijiazhuang Tiedao University, China; Liqun Chen is a professor at Shanghai University, Shanghai, China; Shaohua Li is a professor at Shijiazhuang Tiedao University, China.

NASA Technical Note - United States. National Aeronautics and Space Administration 1973

Computers in Railways XV - C.A. Brebbia 2016-09-15

This title incorporates the 15th proceedings of the very successful International Conference on Railway Engineering Design and Operation (COMPRAIL) series, which began in Frankfurt 1987 and continued in Rome (1990); Washington (1992); Madrid (1994); Berlin (1996); Lisbon (1998); Bologna (2000); Lemnos (2002); Dresden (2004); Prague (2006); Toledo (2008); Beijing (2010); the New Forest, home of the Wessex Institute (2012) and, again in Rome in 2014. The papers presented at this conference aim to update the use of advanced systems, promoting

their general awareness throughout the management, design, manufacture and operation of railways and other emerging passenger, freight and transit systems. With the conference attracting a variety of specialists, including railway engineers, designers of advanced train control systems and computer specialists, the book particularly emphasises the use of computer systems in advanced railway engineering. Topics include but are not restricted to: Advanced train control Operations quality; Risk management; Planning and policy; Energy supply and consumption; Communications and signalling; Operational planning; Interface management; Systems integration; Maglev; High speed technology; Interoperability; Passenger flow management; Computer simulations and Driverless and automatic train operation. Scientific and Technical Aerospace Reports - 1983

Dynamics of Railway Vehicle Systems - Vijay Kumar Garg

1984

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Geometry and Mechanics delivers a comprehensive treatment of the mathematical foundations of railroad vehicle systems. The book includes a strong emphasis on the integration of geometry and mechanics to create an accurate and accessible formulation of nonlinear dynamic equations and general computational algorithms that can be effectively used in the virtual prototyping, analysis, design, and performance evaluation of railroad vehicle systems. Using basic concepts, formulations, and computational algorithms, including mechanics-based approaches like the absolute

nodal coordinate formulation (ANCF), readers will understand how to integrate the geometry and mechanics of railroad vehicle systems. The book also discusses new problems and issues in this area and describes how geometric and mechanical approaches can be used in derailment investigations. Mathematical Foundation of Railroad Vehicle Systems covers: The mathematical foundation of railroad vehicle systems through the integration of geometry and mechanics Basic concepts, formulations, and computational algorithms used in railroad vehicle system dynamics New mechanics-based approaches, like the ANCF, and their use to achieve an integration of geometry and mechanics Use of geometry and mechanics to study derailments New problems and issues in the area of railroad vehicle systems Designed for researchers and practicing engineers who work with railroad vehicle systems, Mathematical Foundation of

Railroad Vehicle Systems:
Geometry and Mechanics can
also be used in senior
undergraduate and graduate

mechanical, civil, and electrical
engineering programs and
courses.

NBS Special Publication - 1918