

Modern Spacecraft Dynamics And Control Kaplan

A textbook for engineers on the basic techniques in the analysis and design of automatic control systems.

Manned Spacecraft Design Principles presents readers with a brief, to-the-point primer that includes a detailed introduction to the information required at the preliminary design stage of a manned space transportation system. In the process of developing the preliminary design, the book covers content not often discussed in a standard aerospace curriculum, including atmospheric entry dynamics, space launch dynamics, hypersonic flow fields, hypersonic heat transfer, and skin friction, along with the economic aspects of space flight. Key concepts relating to human factors and crew support systems are also included, providing users with a comprehensive guide on how to make informed choices from an array of competing options. The text can be used in conjunction with Pasquale Sforza's, Commercial Aircraft Design Principles to form a complete course in Aircraft/Spacecraft Design. Presents a brief, to-the-point primer that includes a detailed introduction to the information required at the preliminary design stage of a manned space transportation system Involves the reader in the preliminary design of a modern manned spacecraft and associated launch vehicle Includes key concepts relating to human factors and crew support systems Contains standard, empirical, and classical methods in support of the design process Culminates in the preparation of a professional quality design report

Orbital Mechanics for Engineering Students, Second Edition, provides an introduction to the basic concepts of space mechanics. These include vector kinematics in three dimensions; Newton's laws of motion and gravitation; relative motion; the vector-based solution of the classical two-body problem; derivation of Kepler's equations; orbits in three dimensions; preliminary orbit determination; and orbital maneuvers. The book also covers relative motion and the two-impulse rendezvous problem; interplanetary mission design using patched conics; rigid-body dynamics used to characterize the attitude of a space vehicle; satellite attitude dynamics; and the characteristics and design of multi-

stage launch vehicles. Each chapter begins with an outline of key concepts and concludes with problems that are based on the material covered. This text is written for undergraduates who are studying orbital mechanics for the first time and have completed courses in physics, dynamics, and mathematics, including differential equations and applied linear algebra. Graduate students, researchers, and experienced practitioners will also find useful review materials in the book. NEW: Reorganized and improved discussions of coordinate systems, new discussion on perturbations and quaternions NEW: Increased coverage of attitude dynamics, including new Matlab algorithms and examples in chapter 10 New examples and homework problems

Roger D. Werking Head, Attitude Determination and Control Section National Aeronautics and Space Administration/ Goddard Space Flight Center Extensive work has been done for many years in the areas of attitude determination, attitude prediction, and attitude control. During this time, it has been difficult to obtain reference material that provided a comprehensive overview of attitude support activities. This lack of reference material has made it difficult for those not intimately involved in attitude functions to become acquainted with the ideas and activities which are essential to understanding the various aspects of spacecraft attitude support. As a result, I felt the need for a document which could be used by a variety of persons to obtain an understanding of the work which has been done in support of spacecraft attitude objectives. It is believed that this book, prepared by the Computer Sciences Corporation under the able direction of Dr. James Wertz, provides this type of reference. This book can serve as a reference for individuals involved in mission planning, attitude determination, and attitude dynamics; an introductory textbook for students and professionals starting in this field; an information source for experimenters or others involved in spacecraft-related work who need information on spacecraft orientation and how it is determined, but who have neither the time nor the resources to pursue the varied literature on this subject; and a tool for encouraging those who could expand this discipline to do so, because much remains to be done to satisfy future needs.

Spaceflight Dynamics

Dynamics, Control and Navigation

Fundamentals of Spacecraft Attitude Determination and Control

Spacecraft Dynamics

An Analytical Approach

An extensive text reference includes around an asteroid - a new and important topic Covers the most updated contents in spacecraft dynamics and control, both in theory and application Introduces the application to motion around asteroids - a new and important topic Written by a very experienced researcher in this area

Satellites are used increasingly in telecommunications, scientific research, surveillance, and meteorology, and these satellites rely heavily on the effectiveness of complex onboard control systems. This 1997 book explains the basic theory of spacecraft dynamics and control and the practical aspects of controlling a satellite. The emphasis throughout is on analyzing and solving real-world engineering problems. For example, the author discusses orbital and rotational dynamics of spacecraft under a variety of environmental conditions, along with the realistic constraints imposed by available hardware. Among the topics covered are orbital dynamics, attitude dynamics, gravity gradient stabilization, single and dual spin stabilization, attitude maneuvers, attitude stabilization, and structural dynamics and liquid sloshing. The goal of this book is to serve both as a practical technical reference and a resource for gaining a fuller understanding of the state of the art of spacecraft momentum control systems, specifically looking at control moment gyroscopes (CMGs). As a result, the subject matter includes theory, technology, and systems engineering. The authors combine material on system-level architecture of spacecraft that feature momentum-control systems with material about the momentum-control hardware and software. This also encompasses material on the theoretical and algorithmic approaches to the control of space vehicles with CMGs. In essence, CMGs are the attitude-control actuators that make contemporary highly agile spacecraft possible. The rise of commercial Earth imaging, the advances in privately built spacecraft (including small satellites), and the growing popularity of the subject matter in academic circles over the past decade argues that now is the time for an in-depth treatment of the topic. CMGs are augmented by reaction wheels and related algorithms for steering all such actuators, which together comprise the field of spacecraft momentum control systems. The material is presented at a level suitable for practicing engineers and those with an undergraduate degree in mechanical, electrical, and/or aerospace engineering.

Good, No Highlights, No Markup, all pages are intact, Slight Shelfwear, may have the corners slightly dented, may have slight color changes/slightly damaged spine.

Spacecraft Momentum Control Systems

A Practical Engineering Approach

Orbital Mechanics for Engineering Students

The Embedded Model Control Approach

Spacecraft Attitude Dynamics

Want to know not just what makes rockets go up but how to do it optimally? Optimal control theory has become such an important field in aerospace engineering that no graduate student or practicing engineer can afford to be without a working knowledge of it. This is the first book

that begins from scratch to teach the reader the basic principles of the calculus of variations, develop the necessary conditions step-by-step, and introduce the elementary computational techniques of optimal control. This book, with problems and an online solution manual, provides the graduate-level reader with enough introductory knowledge so that he or she can not only read the literature and study the next level textbook but can also apply the theory to find optimal solutions in practice. No more is needed than the usual background of an undergraduate engineering, science, or mathematics program: namely calculus, differential equations, and numerical integration. Although finding optimal solutions for these problems is a complex process involving the calculus of variations, the authors carefully lay out step-by-step the most important theorems and concepts. Numerous examples are worked to demonstrate how to apply the theories to everything from classical problems (e.g., crossing a river in minimum time) to engineering problems (e.g., minimum-fuel launch of a satellite). Throughout the book use is made of the time-optimal launch of a satellite into orbit as an important case study with detailed analysis of two examples: launch from the Moon and launch from Earth. For launching into the field of optimal solutions, look no further!

Spacecraft Dynamics and Control: The Embedded Model Control Approach provides a uniform and systematic way of approaching space engineering control problems from the standpoint of model-based control, using state-space equations as the key paradigm for simulation, design and implementation. The book introduces the Embedded Model Control methodology for the design and implementation of attitude and orbit control systems. The logic architecture is organized around the embedded model of the spacecraft and its surrounding environment. The model is compelled to include disturbance dynamics as a repository of the uncertainty that the control law must reject to meet attitude and orbit requirements within the uncertainty class. The source of the real-time uncertainty estimation/prediction is the model error signal, as it encodes the residual discrepancies between spacecraft measurements and model output. The embedded model and the uncertainty estimation feedback (noise estimator in the book) constitute the state predictor feeding the control law. Asymptotic pole placement (exploiting the asymptotes of closed-loop transfer functions) is the way to design and tune feedback loops around the embedded model (state predictor, control law, reference generator). The design versus the uncertainty class is driven by analytic stability and performance inequalities. The method is applied to several attitude and orbit control problems. The book begins with an extensive introduction to attitude

geometry and algebra and ends with the core themes: state-space dynamics and Embedded Model Control. Fundamentals of orbit, attitude and environment dynamics are treated giving emphasis to state-space formulation, disturbance dynamics, state feedback and prediction, closed-loop stability. Sensors and actuators are treated giving emphasis to their dynamics and modelling of measurement errors. Numerical tables are included and their data employed for numerical simulations. Orbit and attitude control problems of the European GOCE mission are the inspiration of numerical exercises and simulations. The suite of the attitude control modes of a GOCE-like mission is designed and simulated around the so-called mission state predictor. Solved and unsolved exercises are included within the text - and not separated at the end of chapters - for better understanding, training and application. Simulated results and their graphical plots are developed through MATLAB/Simulink code.

This text covers fundamentals in navigation of modern aerospace vehicles. It is an excellent resource for both graduate students and practicing engineers.

This book consolidates decades of knowledge on space flight navigation theory, which has thus far been spread across various research articles. By gathering this research into a single text, it will be more accessible to students curious about the study of space flight navigation. Books on optimal control theory and orbital mechanics have not adequately explored the field of space flight navigation theory until this point. The opening chapters introduce essential concepts within optimal control theory, such as the optimization of static systems, special boundary conditions, and dynamic equality constraints. An analytical approach is focused on throughout, as opposed to computational. The result is a book that emphasizes simplicity and practicability, which makes it accessible and engaging. This holds true in later chapters that involve orbital mechanics, two-body maneuvers, bounded inputs, and flight in non-spherical gravity fields. The intended audience is primarily upper-undergraduate students, graduate students, and researchers of aerospace, mechanical, and/or electrical engineering. It will be especially valuable to those with interests in spacecraft dynamics and control. Readers should be familiar with basic dynamics and modern control theory. Additionally, a knowledge of linear algebra, variational methods, and ordinary differential equations is recommended.

Optimal Spacecraft Rotational Maneuvers

Analytical Mechanics of Space Systems

Rigid Body, Multibody, and Aerospace Applications

Advanced Control of Aircraft, Spacecraft and Rockets

Rigid Body Dynamics for Space Applications

This book offers a unified presentation that does not discriminate between atmospheric and space flight. It demonstrates how the two disciplines have evolved from the same set of physical principles and introduces a broad range of critical concepts in an accessible, yet mathematically rigorous presentation. The book presents many MATLAB and Simulink-based numerical examples and real-world simulations. Replete with illustrations, end-of-chapter exercises, and selected solutions, it is primarily useful as a textbook for advanced undergraduate and beginning graduate-level students.

Spacecraft Attitude Control: A Linear Matrix Inequality Approach solves problems for spacecraft attitude control using convex optimization, and more specifically, through a linear matrix inequalities approach (LMI). High-precision attitude pointing and improved robustness in the face of external disturbances and other uncertainties are requirements for the current generation of spacecraft. The title develops an LMI approach to spacecraft attitude control and shows that the uncertainties in the maneuvering process can be solved numerically. The book develops a wide variety of novel and robust controllers, applicable both to spacecraft attitude control and easily extendible to second-order systems. This title addresses spacecraft attitude control and robust systems, giving an extensive survey of current research and helping researchers improve robust control performance. Considers the control requirements of modern spacecraft Presents rigid and flexible spacecraft control systems with inherent mathematical uncertainties that lead to a model-like state-space Develops novel and robust controllers directly applicable to spacecraft control and extendable to other second-order systems systematic survey of recent research in spacecraft attitude control

A modern and unified treatment of the mechanics, planning, and control of robots, suitable for a first course in robotics. Mechanical engineering, and engineering discipline born of the needs of the industrial revolution, is once again asked to share a substantial share in the call for industrial renewal. The general call is urgent as we face profound issues of production and competitiveness that require engineering solutions, among others. The Mechanical Engineering Series is a series of graduate texts and research monographs intended to address the need for information in contemporary areas of mechanical engineering. The series is conceived as a comprehensive one that covers a broad range of concentrations important to mechanical engineering graduate education and research. We are fortunate to have a distinguished roster of series editors, each an expert in one of the areas of concentration. The names of the series editors are listed on page vi of this book. The areas of concentration are applied mechanics, biomechanics, computational mechanics, dynamic systems and control, energetics, mechanics of materials, processing, thermal science, and tribology. Preface This book is based on my experience with the control systems of antennas and radiotelescopes. Overwhelmingly, it is based on experience with the NA

Space Network (DSN) antennas. It includes modeling the antennas, developing control algorithms, field testing, system integration, performance evaluation, and troubleshooting. My previous book emphasized the theoretical aspects of antenna control engineering, while this one describes the application part of the antenna control engineering.

Flight Dynamics and Control of Aero and Space Vehicles

Progress in Astronautics and Aeronautics

Fundamentals of Aerospace Navigation and Guidance

Spacecraft Attitude Determination and Control

Practical Astrodynamics

Flight Vehicle Dynamics and Control Rama K. Yedavalli, The Ohio State University, USA A comprehensive textbook which presents flight vehicle dynamics and control in a unified framework Flight Vehicle Dynamics and Control presents the dynamics and control of various flight vehicles, including aircraft, spacecraft, helicopter, missiles, etc, in a unified framework. It covers the fundamental topics in the dynamics and control of these flight vehicles, highlighting shared points as well as differences in dynamics and control issues, making use of the 'systems level' viewpoint. The book begins with the derivation of the equations of motion for a general rigid body and then delineates the differences between the dynamics of various flight vehicles in a fundamental way. It then focuses on the dynamic equations with application to these various flight vehicles, concentrating more on aircraft and spacecraft cases. Then the control systems analysis and design is carried out both from transfer function, classical control, as well as modern, state space control points of view. Illustrative examples of application to atmospheric and space vehicles are presented, emphasizing the 'systems level' viewpoint of control design. Key features:

Provides a comprehensive treatment of dynamics and control of various flight vehicles in a single volume. Contains worked out examples (including MATLAB examples) and end of chapter homework problems. Suitable as a single textbook for a sequence of undergraduate courses on flight vehicle dynamics and control. Accompanied by a website that includes additional problems and a solutions manual. The book is essential reading for undergraduate students in mechanical and aerospace engineering, engineers working on flight vehicle control, and researchers from other engineering backgrounds working on related topics.

Presents the established principles underpinning space robotics with a thorough and modern approach. This text is perfect for professionals in the field looking to gain an understanding of real-life applications of manipulators on satellites, and of the dynamics of satellites carrying robotic manipulators and of planetary rovers.

A thorough understanding of rigid body dynamics as it relates to modern mechanical and aerospace systems

requires engineers to be well versed in a variety of disciplines. This book offers an all-encompassing view by interconnecting a multitude of key areas in the study of rigid body dynamics, including classical mechanics, spacecraft dynamics, and multibody dynamics. In a clear, straightforward style ideal for learners at any level, Advanced Dynamics builds a solid fundamental base by first providing an in-depth review of kinematics and basic dynamics before ultimately moving forward to tackle advanced subject areas such as rigid body and Lagrangian dynamics. In addition, Advanced Dynamics: Is the only book that bridges the gap between rigid body, multibody, and spacecraft dynamics for graduate students and specialists in mechanical and aerospace engineering Contains coverage of special applications that highlight the different aspects of dynamics and enhances understanding of advanced systems across all related disciplines Presents material using the author's own theory of differentiation in different coordinate frames, which allows for better understanding and application by students and professionals Both a refresher and a professional resource, Advanced Dynamics leads readers on a rewarding educational journey that will allow them to expand the scope of their engineering acumen as they apply a wide range of applications across many different engineering disciplines.

This book is an up-to-date compendium on spacecraft attitude and orbit control (AOC) that offers a systematic and complete treatment of the subject with the aim of imparting the theoretical and practical knowledge that is required by designers, engineers, and researchers. After an introduction on the kinematics of the flexible and agile space vehicles, the modern architecture and functions of an AOC system are described and the main AOC modes reviewed with possible design solutions and examples. The dynamics of the flexible body in space are then considered using an original Lagrangian approach suitable for the control applications of large space flexible structures. Subsequent chapters address optimal control theory, attitude control methods, and orbit control applications, including the optimal orbital transfer with finite and infinite thrust. The theory is integrated with a description of current propulsion systems, with the focus especially on the new electric propulsion systems and state of the art sensors and actuators.

A Linear Matrix Inequality Approach
Modern Spacecraft Dynamics and Control
Manned Spacecraft Design Principles
Technologies by Giovanni Campolo
Control System Dynamics

Thorough coverage of space flight topics with self-contained chapters serving a variety of courses in orbital mechanics,

spacecraft dynamics, and astronautics This concise yet comprehensive book on space flight dynamics addresses all phases of a space mission: getting to space (launch trajectories), satellite motion in space (orbital motion, orbit transfers, attitude dynamics), and returning from space (entry flight mechanics). It focuses on orbital mechanics with emphasis on two-body motion, orbit determination, and orbital maneuvers with applications in Earth-centered missions and interplanetary missions. Space Flight Dynamics presents wide-ranging information on a host of topics not always covered in competing books. It discusses relative motion, entry flight mechanics, low-thrust transfers, rocket propulsion fundamentals, attitude dynamics, and attitude control. The book is filled with illustrated concepts and real-world examples drawn from the space industry. Additionally, the book includes a “computational toolbox” composed of MATLAB M-files for performing space mission analysis. Key features: Provides practical, real-world examples illustrating key concepts throughout the book Accompanied by a website containing MATLAB M-files for conducting space mission analysis Presents numerous space flight topics absent in competing titles Space Flight Dynamics is a welcome addition to the field, ideally suited for upper-level undergraduate and graduate students studying aerospace engineering.

Provides the basics of spacecraft orbital dynamics plus attitude dynamics and control, using vectrix notation Spacecraft Dynamics and Control: An Introduction presents the fundamentals of classical control in the context of spacecraft attitude control. This approach is particularly beneficial for the training of students in both of the subjects of classical control as well as its application to spacecraft attitude control. By using a physical system (a spacecraft) that the reader can visualize (rather than arbitrary transfer functions), it is easier to grasp the motivation for why topics in control theory are important, as well as the theory behind them. The entire treatment of both orbital and attitude dynamics makes use of vectrix notation, which is a tool that allows the user to write down any vector equation of motion without consideration of a reference frame. This is particularly suited to the treatment of multiple reference frames. Vectrix notation also makes a very clear distinction between a physical vector and its coordinate representation in a reference frame. This is very important in spacecraft dynamics and control problems, where often multiple coordinate representations are used (in different reference frames) for the same physical vector. Provides an accessible, practical aid for teaching and self-study with a layout enabling a fundamental understanding of the subject Fills a gap in the existing literature by providing an analytical toolbox offering the reader a lasting, rigorous methodology for approaching vector mechanics, a key element vital to new graduates and practicing engineers alike Delivers an outstanding resource for aerospace engineering students, and all those involved in the technical aspects of design and engineering in the space sector Contains numerous illustrations to accompany the written text. Problems are included to apply and extend the material in each chapter Essential reading for graduate level aerospace engineering students, aerospace professionals, researchers and engineers.

"Space Vehicle Dynamics and Control provides a solid foundation in dynamic modeling, analysis, and control of space vehicles. More than 200 figures, photographs, and tables are featured in detailed sections covering the fundamentals of controlling orbital, attitude, and structural motions of space vehicles. The textbook highlights a range of orbital maneuvering and control problems: orbital transfer, rendezvous, and halo orbit determination and control. Rotational maneuvering and attitude control problems of space vehicles under the influence of reaction jet firings, internal energy dissipation, or momentum transfer via reaction wheels and control moment gyros are treated in detail. The textbook also highlights the analysis and design of attitude control systems in the presence of structural flexibility and/or propellant sloshing. At the end of each chapter, Dr. Wie includes a helpful list of references for graduate students and working professionals studying spacecraft dynamics and control. A bibliography of more than 350 additional references in the field of spacecraft guidance, control, and dynamics is also provided at the end of the book. This text requires a thorough knowledge of vector and matrix algebra, calculus, ordinary differential equations, engineering mechanics, and linear system dynamics and control. The first two chapters provide a summary of such necessary background material. Since some problems may require the use of software for the analysis, control design, and numerical simulation, readers should have access to computational software (i.e., MATLAB) on a personal computer.

This book discusses all spacecraft attitude control-related topics: spacecraft (including attitude measurements, actuator, and disturbance torques), modeling, spacecraft attitude determination and estimation, and spacecraft attitude controls. Unlike other books addressing these topics, this book focuses on quaternion-based methods because of its many merits. The book lays a brief, but necessary background on rotation sequence representations and frequently used reference frames that form the foundation of spacecraft attitude description. It then discusses the fundamentals of attitude determination using vector measurements, various efficient (including very recently developed) attitude determination algorithms, and the instruments and methods of popular vector measurements. With available attitude measurements, attitude control designs for inertial point and nadir pointing are presented in terms of required torques which are independent of actuators in use. Given the required control torques, some actuators are not able to generate the accurate control torques, therefore, spacecraft attitude control design methods with achievable torques for these actuators (for example, magnetic torque bars and control moment gyros) are provided. Some rigorous controllability results are provided. The book also includes attitude control in some special maneuvers, such as orbital-raising, docking and rendezvous, that are normally not discussed in similar books. Almost all design methods are based on state-spaced modern control approaches, such as linear quadratic optimal control, robust pole assignment control, model predictive control, and gain scheduling control. Applications of these methods to spacecraft attitude control problems are provided. Appendices are provided for readers

who are not familiar with these topics.

Advanced Dynamics

Spacecraft Attitude Control

Models, Methods and Applications

Modeling and Simulation with MATLAB® and Simulink®

Spacecraft Dynamics and Control

Topics include orbital and attitude maneuvers, orbit establishment and orbit transfer, plane rotation, interplanetary transfer and hyperbolic passage, lunar transfer, reorientation with constant momentum, attitude determination, more. Answers to selected exercises. 1976 edition.

This monograph has grown out of the authors' recent work directed toward solving a family of problems which arise in maneuvering modern spacecraft. The work ranges from fundamental developments in analytical dynamics and optimal control to a significant collection of example applications. The primary emphasis herein is upon the most central analytical and numerical methods for determining optimal rotational maneuvers of spacecraft. The authors focus especially upon the large angle nonlinear maneuvers, and also consider large rotational maneuvers of flexible vehicles with simultaneous vibration suppression/arrest. Each chapter includes a list of references. The book provides much new material which will be of great interest to practising professionals and advanced graduate students working in the general areas of spacecraft technology, applied mathematics, optimal control theory, and numerical optimization. Chapter 11 in particular presents new information that will be found widely useful for terminal control and tracking maneuvers.

Rigid Body Dynamics for Space Applications explores the modern problems of spaceflight mechanics, such as attitude dynamics of re-entry and space debris in Earth's atmosphere; dynamics and control of coaxial satellite gyrostats; deployment, dynamics, and control of a tether-assisted return mission of a re-entry capsule; and removal of large space debris by a tether tow. Most space systems can be considered as a system of rigid bodies, with additional elastic and viscoelastic elements and fuel residuals in some cases. This guide shows the nature of the phenomena and explains the behavior of space objects. Researchers working on spacecraft attitude dynamics or space debris removal as well as those in the fields of mechanics, aerospace engineering, and aerospace science will benefit from this book. Provides a complete treatise of modeling attitude for a range of novel and modern attitude control problems of spaceflight mechanics Features chapters on the application of rigid body dynamics to atmospheric re-entries, tethered assisted re-entry, and tethered space debris removal Shows relatively simple ways of constructing mathematical models and analytical solutions describing the behavior of very complex material systems Uses modern methods of regular and chaotic dynamics to obtain results

Pointing a satellite in the right direction requires an extremely complex system — one that describes the satellite's orientation and at the same time predicts and either uses or neutralizes external influences. From its roots in classical mechanics and reliance on stability theory to the evolution of practical stabilization ideas, Spacecraft Attitude Dynamics offers comprehensive coverage of environmental torques encountered in space; energy dissipation and its effects on the attitude stability of spinning bodies; motion equation for four archetypical systems derived and

used repeatedly throughout the text; orientation parameters (not limited to Euler angles); illustrations of key concepts with on-orbit flight data; and typical engineering hardware, with examples of the implementation of dynamic ideas. Suitable as a text for advanced undergraduates and graduate students, this unified treatment is also a valuable reference for professional engineers studying the analysis and application of modern spacecraft attitude dynamics. The sole prerequisites are a fundamental knowledge of vector dynamics and matrix algebra. Over 250 diagrams appear throughout the text, along with extensive problem sets at the end of each chapter, 350 references (cited, interpreted, and placed in perspective to reinforce the material), and two helpful appendixes.

Space Flight Dynamics

An Introduction

Advances in Spacecraft Attitude Control

Atmospheric and Space Flight Dynamics

Optimal Space Flight Navigation

Space agencies are now realizing that much of what has previously been achieved using hugely complex and costly single platform projects—large unmanned and manned satellites (including the present International Space Station)—can be replaced by a number of smaller satellites networked together. The key challenge of this approach, namely ensuring the proper formation flying of multiple craft, is the topic of this second volume in Elsevier's Astrodynamics Series, *Spacecraft Formation Flying: Dynamics, control and navigation*. In this unique text, authors Alfried et al. provide a coherent discussion of spacecraft relative motion, both in the unperturbed and perturbed settings, explain the main control approaches for regulating relative satellite dynamics, using both impulsive and continuous maneuvers, and present the main constituents required for relative navigation. The early chapters provide a foundation upon which later discussions are built, making this a complete, standalone offering. Intended for graduate students, professors and academic researchers in the fields of aerospace and mechanical engineering, mathematics, astronomy and astrophysics, *Spacecraft Formation Flying* is a technical yet accessible, forward-thinking guide to this critical area of astrodynamics.

The first book dedicated to spacecraft formation flying, written by leading researchers and professors in the field

Develops the theory from an astrodynamical viewpoint, emphasizing modeling, control and navigation of formation flying satellites on Earth orbits Examples used to illustrate the main developments, with a sample simulation of a formation flying mission included to illustrate high fidelity modeling, control and relative navigation

Written for aerospace engineering courses of senior undergraduate or graduate level, this work presents basic concepts, methods and mathematical developments in spacecraft attitude dynamics and control. Topics covered include rigid body dynamics, environmental effects and linear control theory.

Designed for undergraduate courses in Spacecraft Dynamics and Orbital Mechanics, this new edition offers a three-dimensional treatment of dynamics discussions of rigid body dynamics, rocket trajectories, and the space environment. An expert in his field, author William E. Wiesel presents a wealth of information in an easy-to-understand manner without the daunting mathematical rigor of graduate texts. Reference is made to actual flight vehicles and satellites to give students background on the type of work currently being done in this field.

This modern presentation guides readers through the theory and practice of satellite orbit prediction and determination. Starting from the basic principles of orbital mechanics, it covers elaborate force models as well as precise methods of satellite tracking. The accompanying CD-ROM includes source code in C++ and relevant data files for applications. The result is a powerful and unique spaceflight dynamics library, which allows users to easily create software extensions. An extensive collection of frequently updated Internet resources is provided through WWW hyperlinks.

Quaternion-Based Approach

An American Institute of Aeronautics and Astronautics Series

Spacecraft Attitude Dynamics and Control

Modeling and Control of Antennas and Telescopes

Optimal Control with Aerospace Applications

This modern textbook guides the reader through the theory and practice of the motion and attitude control of space vehicles. It first presents the fundamental principles of spaceflight mechanics and then addresses more complex concepts and applications of perturbation theory, orbit determination and refinement, space propulsion, orbital maneuvers, interplanetary trajectories, gyroscope dynamics, attitude control, and rocket performance. Many algorithms used in the modern practice of trajectory computation are also provided. The numerical treatment of the equations of motion, the related methods, and the tables needed to use them receive particular emphasis. A large collection of bibliographical references (including books, articles, and items from the "gray literature") is provided at the end of each chapter, and attention is drawn to many internet resources available to the reader. The book will be of particular value to undergraduate and graduate students in aerospace engineering.

Advanced Control of Aircraft, Spacecraft and Rockets introduces the reader to the concepts of modern control theory applied to the design and analysis of general flight control systems in a concise and mathematically rigorous style. It presents a comprehensive treatment of both atmospheric and space flight control systems including aircraft, rockets (missiles and launch vehicles), entry vehicles and spacecraft (both orbital and attitude control). The broad coverage of topics emphasizes the synergies among the various flight control systems and attempts to show their evolution from the same set of

physical principles as well as their design and analysis by similar mathematical tools. In addition, this book presents state-of-art control system design methods - including multivariable, optimal, robust, digital and nonlinear strategies - as applied to modern flight control systems. Advanced Control of Aircraft, Spacecraft and Rockets features worked examples and problems at the end of each chapter as well as a number of MATLAB / Simulink examples housed on an accompanying website at <http://home.iitk.ac.in/~ashtew> that are realistic and representative of the state-of-the-art in flight control.

Spacecraft attitude maneuvers comply with Euler's moment equations, a set of three nonlinear, coupled differential equations. Nonlinearities complicate the mathematical treatment of the seemingly simple action of rotating, and these complications lead to a robust lineage of research. This book is meant for basic scientifically inclined readers, and commences with a chapter on the basics of spaceflight and leverages this remediation to reveal very advanced topics to new spaceflight enthusiasts. The topics learned from reading this text will prepare students and faculties to investigate interesting spaceflight problems in an era where cube satellites have made such investigations attainable by even small universities. It is the fondest hope of the editor and authors that readers enjoy this book. This book explores topics that are central to the field of spacecraft attitude determination and control. The authors provide rigorous theoretical derivations of significant algorithms accompanied by a generous amount of qualitative discussions of the subject matter. The book documents the development of the important concepts and methods in a manner accessible to practicing engineers, graduate-level engineering students and applied mathematicians. It includes detailed examples from actual mission designs to help ease the transition from theory to practice and also provides prototype algorithms that are readily available on the author's website. Subject matter includes both theoretical derivations and practical implementation of spacecraft attitude determination and control systems. It provides detailed derivations for attitude kinematics and dynamics and provides detailed description of the most widely used attitude parameterization, the quaternion. This title also provides a thorough treatise of attitude dynamics including Jacobian elliptical functions. It is the first known book to provide detailed derivations and explanations of state attitude determination and gives readers real-world examples from actual working spacecraft missions. The subject matter is chosen to fill the void of existing textbooks and treatises, especially in state and dynamics attitude determination. MATLAB code of all examples will be provided through an external website.

Spacecraft Modeling, Attitude Determination, and Control

Fundamental Spacecraft Dynamics and Control

Space Vehicle Dynamics and Control

Performance, Stability, Dynamics, and Control of Airplanes

Dynamics and Control of Autonomous Space Vehicles and Robotics

Comprehensive coverage includes environmental torques, energy dissipation, motion equations for four archetypical systems, orientation parameters, illustrations of key concepts with on-orbit flight data, and typical engineering hardware. 1986 edition.

Satellite Orbits

Flexible Spacecraft Dynamics, Control and Guidance

Modern Robotics

Spacecraft Formation Flying