Modern Spacecraft Dynamics And Control Kaplan

Proceedings of the International Workshop, Delhi, India, November 14-16, 1985

Annotation This text discusses the conceptual stages of mission design, systems engineering, and orbital mechanics, providing a basis for understanding the design process for different components and functions of a spacecraft. Coverage includes propulsion and power systems, structures, attitude control, thermal control, command and data systems, and telecommunications. Worked examples and exercises are included, in addition to appendices on acronyms and abbreviations and spacecraft design data. The book can be used for self-study or for a course in spacecraft design. Brown directed the team that produced the Magellan spacecraft, and has taught spacecraft design at the University of Colorado. Annotation c. Book News, Inc., Portland, OR (booknews.com).

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.

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.

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.

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.

The numerous applications of optimal control theory have given an incentive to the development of approximate techniques aimed at the construction of control laws and the optimization of dynamical systems. These constructive approaches rely on small parameter methods (averaging, regular and singular perturbations), which are well-known and have been proven to be efficient in nonlinear mechanics and optimal control theory (maximum principle, variational calculus and dynamic programming). An essential feature of the procedures for solving optimal control problems consists in the necessity for dealing with two-point boundary-value problems for nonlinear and, as a rule, nonsmooth multi-dimensional sets of differential equations. This circumstance complicates direct applications of the above-mentioned perturbation methods which have been developed mostly for investigating initial-value (Cauchy) problems. There is now a need for a systematic presentation of constructive analytical per turbation methods relevant to optimal control problems for nonlinear systems. The purpose of this book is to meet this need in the English language scientific literature and to present consistently small parameter techniques relating to the constructive investigation of some classes of optimal control problems which often arise in prac tice. This book is based on a revised and modified version of the monograph: L. D. Akulenko "Asymptotic methods in optimal control". Moscow: Nauka, 366 p. (in Russian).

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.

The range of solar sailing is very vast; it is a fully in-space means of propulsion that should allow us to accomplish various mission classes that are literally impossible using rocket propulsion, no matter if nuclear or electric. Fast and very fast solar sailings are special classes of sailcraft missions, initially developed only in the first half of the 1990s and still evolving, especially after the latest advances in nanotechnology. This book describes how to plan, compute and optimize the trajectories of sailcraft with speeds considerably higher than 100 km/s; such sailcraft would be able to explore the outer heliosphere, the near interstellar medium and the solar gravitational lens (550-800 astronomical units) in times significantly shorter than the span of an average career (~ 35 years), just to cite a few examples. The scientific interest in this type of exploration is huge.

This textbook introduces undergraduate students to engineering dynamics using an innovative approach that is at once accessible and comprehensive. Combining the strengths of both beginner and advanced dynamics texts, this book has students solving dynamics problems from the very start and gradually guides them from the basics to increasingly more challenging topics without ever sacrificing rigor. Engineering Dynamics spans the full range of mechanics problems, from one-dimensional particle kinematics to three-dimensional rigid-body dynamics, including an introduction to Lagrange's and Kane's methods. It skillfully blends an easy-to-read, conversational style with careful attention to the physics and mathematics of engineering dynamics, and emphasizes the formal systematic notation students need to solve problems correctly and succeed in more advanced courses. This richly illustrated textbook features numerous real-world examples and problems, incorporating a wide range of difficulty; ample use of MATLAB for solving problems; helpful tutorials; suggestions for further reading; and detailed appendixes. Provides an accessible yet rigorous introduction to engineering dynamics Uses an explicit vector-based notation to facilitate understanding Professors: A supplementary Instructor's Manual is available for this book. It is restricted to teachers using the text in courses. For information on how to obtain a copy, refer to: http://press.princeton.edu/class_use/solutions.html

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 book is written for an introductory course in space technology. It is intended for senior or graduate level aerospace engineering students and professional engineers seeking a thorough understanding of the aerospace aspects of space systems. As such it focuses on the primary physics and engineering fundamentals necessary to understand and design space based systems. The book does not include the basics of spacecraft electronics, because this is covered in many systems and electronics books and is typically covered in follow-up courses. * Derived from the author's thirty years of experience in the aerospace industry and several years of university teaching experience * More than 130 illustrations * Advanced subjects and problems indicated by asterisks(*)allow the reader and the instructor to omit topics without losing continuity * All chapters correspond to the engineering subdivisions typically found in the aerospace industry * Includes United States and international technologies * Extensive appendix of important data, not easily located in other sources * The book does not include the basics of spacecraft electronics

In order to reflect the increasing importance and interest of the microsatellites in high technology and scientific applications in space, the Colloquium on Microsatellites as Research Tools was organized to promote its usage and technology development and to foster the international cooperation, especially in the area of the Asia pacific region. Attended by 150 participants from 18 countries the colloquium was organized into five major themes: regional development, lessons learned, innovations, scientific applications, and education. A special session was organized as well by the organizing committee and supported by the National Space Program Office to present its development of the Taiwan's satellite program and the current status of ROCSAT-1 which is scheduled to be launched at the beginning of 1999. Two main conclusions were drawn from the material presented: microsatellite in general is a very good means for doing space research and technology development, and a suitable vehicle to promote international collaborations.

Attitude dynamics is the theoretical basis of attitude control of spacecrafts in aerospace engineering. With the development of nonlinear dynamics, chaos in spacecraft attitude dynamics has drawn great attention since the 1990's. The problem of the predictability and controllability of the chaotic attitude motion of a spacecraft has a practical significance in astronautic science. This book aims to summarize basic concepts, main approaches, and recent progress in this area. It focuses on the research work of the author and other Chinese scientists in this field, providing new methods and viewpoints in the investigation of spacecraft attitude motion, as well as new mathematical models, with definite engineering backgrounds, for further analysis. Professor Yanzhu Liu was the Director of the Institute of Engineering Mechanics, Shanghai Jiao Tong University, China. Dr. Liqun Chen is a Professor at the Department of Mechanics, Shanghai University, China.

The motion of mechanical systems undergoing rotation about a fixed axis has been the subject of extensive studies over a few centuries. These systems are generally subject to gyroscopic forces which are associated with coriolis accelerations or mass transport and render complex dynamics.The unifying theme among topics presented in this book is the gyroscopic nature of the system equations of motion. The book represents comprehensive and detailed reviews of the state of art in four diverse application areas: flow-induced oscillations in structures, oscillations in rotating systems or rotor dynamics, dynamics of axially moving material systems, and dynamics of gyroelastic systems. The book also includes a chapter on dynamics of repetitive structures. These systems feature spatial periodicity and are generally subject to considerable gyroscopic forces. ?Gyroelastic systems? and ?repetitive structures? are the topics with very recent origins and are still in their infancies compared to the other examples represented in this book. Thus, the contributions on gyroelastic systems and repetitive structures are limited to only modeling, localization and linear stability analysis results.This book covers many important aspects of recent developments in various types of gyroscopic systems. Thus, at last, a comprehensive book is made available to serve as a supplement and resource for any graduate level course on elastic gyroscopic systems, as well as for a course covering the stability of mechanical systems. Moreover, the inclusion of an up-to-date bibliography attached to each chapter will make this book an invaluable text for professional reference.

The study of complex, interconnected mechanical systems with rigid and flexible articulated components is of growing interest to both engineers and mathematicians. Recent work in this area reveals a rich geometry underlying the mathematical models used in this context. In particular, Lie groups of symmetries, reduction, and Poisson structures play a significant role in explicating the qualitative properties of multibody systems. In engineering applications, it is important to exploit the special structures of mechanical systems. For example, certain mechanical problems involving control of interconnected rigid bodies can be formulated as Lie-Poisson systems. The dynamics and control of robotic, aeronautic, and space structures involve difficulties in modeling, mathematical analysis, and numerical implementation. For example, a new generation of spacecraft with large, flexible components are presenting new challenges to the accurate modeling and prediction of the dynamic behavior of such structures. Recent developments in Hamiltonian dynamics and coupling of systems with symmetries has shed new light on some of these issues, while engineering questions have suggested new mathematical structures. These kinds of considerations motivated the organization of the AMS-IMS-SIAM Joint Summer Research Conference on Control Theory and Multibody Systems, held at Bowdoin College in August, 1988. This volume contains the proceedings of that conference. The papers presented here cover a range of topics, all of which could be viewed as applications of geometrical methods to problems arising in dynamics and control. The volume contains contributions from some of the top researchers and provides an excellent overview of the frontiers of research in this burgeoning area.

Most newcomers to the field of linear stochastic estimation go through a difficult process in understanding and applying the theory.This book minimizes the process while introducing the fundamentals of optimal estimation. Optimal Estimation of Dynamic Systems explores topics that are important in the field of control where the signals receiv

This textbook covers fundamental and advanced topics in orbital mechanics and astrodynamics to expose the student to the basic dynamics of space flight. The engineers and graduate students who read this class-tested text will be able to apply their knowledge to mission design and navigation of space missions. Through highlighting basic, analytic and computer-based methods for designing interplanetary and orbital trajectories, this text provides excellent insight into astronautical techniques and tools. This book is ideal for graduate students in Astronautical or Aerospace Engineering and related fields of study, researchers in space industrial and governmental research and development facilities, as well as researchers in astronautics. This book also: · Illustrates all key concepts with examples · Includes exercises for each chapter · Explains concepts and engineering tools a student or experienced engineer can apply to mission design and navigation of space missions · Covers fundamental principles to expose the student to the basic dynamics of space flight

Roger D. Werking Head, Attitude Determination and Control Section National Aeronautics and Space Administration/ Goddard Space Flight Center Extensiye 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 stu dents and professionals starting in this field; an information source for experimen ters 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.

There is no dearth of books on telescope optics and, indeed, optics is clearly a keyelementinthedesignandconstructionoftelescopes.Butitisbynomeans the only important element. As telescopes become larger and more costly, other aspects such as structures, pointing, wavefront control, enclosures, and project management become just as critical. Although most of the technical knowledge required for all these ?elds is available in various specialized books, journal articles, and technical reports, they are not necessarily written with application to telescopes in mind. This bookisa?rstattemptatassemblinginasingletextthebasicastronomicaland engineering principles used in the design and construction of large telescopes. Itsaimistobroadlycoverallmajoraspectsofthe?eld,fromthefundamentals ofastronomicalobservationto optics, controlsystems,structural,mechanical, andthermalengineering,aswellasspecializedtopicssuchassiteselectionand program management. This subject is so vast that an in-depth treatment is obviously imprac- cal. Our intent is therefore only to provide a comprehensive introduction to the essential aspects of telescope design and construction. This book will not replace specialized scienti?c and technical texts. But we hope that it will be useful for astronomers, managers, and systems engineers who seek a basic understanding of the underlying principles of telescope making, and for s- cialists who wish to acquaint themselves with the fundamental requirements and approaches of their colleagues in other disciplines.

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.

Provides the basics of spacecraft orbital dynamics plusattitude dynamics and control, using vectrix notation Spacecraft Dynamics and Control: An Introductionpresents the fundamentals of classical control in the context ofspacecraft attitude control. This approach is particularlybeneficial for the training of students in both of the subjects ofclassical control as well as its application to spacecraft attitudecontrol. By using a physical system (a spacecraft) that the readercan visualize (rather than arbitrary transfer functions), it iseasier to grasp the motivation for why topics in control theory areimportant, as well as the theory behind them. The entiretreatment of both orbital and attitude dynamics makes use ofvectrix notation, which is a tool that allows the user to writedown any vector equation of motion without consideration of areference frame. This is particularly suited to the treatment ofmultiple reference frames. Vectrix notation also makes a very cleardistinction between a physical vector and its coordinaterepresentation in a reference frame. This is very important inspacecraft dynamics and control problems, where often multiplecoordinate representations are used (in different reference frames)for the same physical vector. Provides an accessible, practical aid for teaching andself-study with a layout enabling a fundamental understanding ofthe subject Fills a gap in the existing literature by providing ananalytical toolbox offering the reader a lasting, rigorousmethodology for approaching vector mechanics, a key element vitalto new graduates and practicing engineers alike Delivers an outstanding resource for aerospace engineeringstudents, and all those involved in the technical aspects of designand engineering in the space sector Contains numerous illustrations to accompany the written text.Problems are included to apply and extend the material in eachchapter Essential reading for graduate level aerospace engineeringstudents, aerospace professionals, researchers and engineers.

A fascinating introduction to the basic principles of orbital mechanics It has been three hundred years since Isaac Newton first formulated laws to explain the orbits of the Moon and the planets of our solar system. In so doing he laid the groundwork for modern science's understanding of the workings of the cosmos and helped pave the way to the age of space exploration. Adventures in Celestial Mechanics offers students an enjoyable way to become acquainted with the basic principles involved in the motions of natural and human-made bodies in space. Packed with examples in which these principles are applied to everything from a falling stone to the Sun, from space probes to galaxies, this updated and revised Second Edition is an ideal introduction to celestial mechanics for students of astronomy, physics, and aerospace engineering. Other features that helped make the first edition of this book the text of choice in colleges and universities across North America include: * Lively historical accounts of important discoveries in celestial mechanics and the men and women who made them * Superb illustrations, photographs, charts, and tables * Helpful chapter-end examples and problem sets

One decade ... 66 Countries … more than 1500 Nano-satellites launched. Nanosatellite technology evolved from the small satellite pedigree has now taken a giant leap in the development of 'new-gen satellite systems'. With about 500 of these Nanosatellites launched by Universities / Academic Institutions shows the affordability of this new ecosystem, which can provide immense opportunity for students and faculty for innovation in space science / technology. This book, authored by a group of space-technology experts of “Planet Aerospace, India” having vast experience in building world-class satellites at ISRO, provides in a nutshell the technology of the future - the building blocks for a Nanosatellite at your premises. The infectious enthusiasm and unbridled passion for Space Science and Technology have been the hallmark of their knowledge and dedication. “The Space science, technology and applications are encompassing every facet of human life on our holistic planet earth and are the new frontier for the present-day student’s community for kindling their insatiable curiosity. This celestial platform submitted on a platter through this unique book “Quintessence of Nano Satellite technology” by Planet Aerospace is a noteworthy initiative in the Indian Space technology arena”. Dr.K.Kasturirangan Former MP and Chairman, ISRO, Secretary Dept of Space “It is heartening to note the efforts of Planet Aerospace to publish the Book on “Quintessence of Nano Satellite Technology” for the benefit of students and space technology enthusiasts. This will definitely help the students to understand the complexities of building Satellites. Books on such contemporary subjects are the need of the hour as they go a long way in inculcating scientific temper in the formative young minds” Dr.K.Sivan, Chairman, ISRO, Secretary, Dept of Space “Nano Satellite technology has opened up new era of innovations in which students of different disciplines learn to work together in any multidisciplinary environment. Hope, this book” Quintessence of Nano Satellite Technology” will become a milestone in boosting Nano satellite activities and demystifying space” Dr.P.S.Goel, Former Secretary, MoES and Director, ISRO Satellite Center

The analysis and computational techniques associated with the navigation and guidance of spacecraft are now in a mature state of development. However the documentation has remained dispersed throughout conference papers, journals, company and contract rep orts, making it difficult to get a true, comprehensive picture of the subject. This text brings together the body of literature with suitable attention to the necessary underlying mathematics and computational techniques. It covers in detail the necessary orbital mechanics, orbit determination with emphasis on the SRIF algorithm, gr avity assist manoeuvres and guidance, both ground-based and autonomous. Attention is paid to all phases of a space mission including launch and re-entry, and whether culminating in an earth satellite or a deep space mission to planets or primitive bodies. Software associated with the text is available free to the reader by means of the Internet server of the publisher. 'Spacecraft Navigation and Guidance' is an invaluable aid for all those working within astronautics, aeronautics, and control engineering in general.

From the preface: "The present text deals with attitude dynamics and is devoted to satellites of finite size. It begins with a discussion of the inertia moment tensor, Euler's law, Euler's angles, Euler's equations, and Euler's frequencies. After that a thorough treatment of the concept of centre of gravity versus centre of mass is given. After libration has been discussed and gyrodynamics proper has been dealt with, the attitude of the moment-free satellite, including the gyrostat, is studied. Particular attention is paid to the attitude behaviour of torquefree single and dual spinners, and the new collinearity theorems are introduced and explored to predict attitude stability and attitude drift. The derivation of each significant formula is followed by the discussion of a practical sample problem in order to acquaint the student with typical situations, typical results, and typical numerical values. There are numerous problems following each chapter. The most important data and the answers to the problems are compiled in appendices."

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

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 discusions of coordinate systems, new discussion on perturbations and quarternions NEW: Increased coverage of attitude dynamics, including new Matlab algorithms and examples in chapter 10 New examples and homework problems

The attitude maneuvering process for spacecraft involves uncertainties for both rigid and flexible spacecraft, leading to chaotic motion. Analytic solutions to these problems do exist, but in all cases they can be solved through numerical methods. Specifically, uncertainties in controllers can be reduced through a linear matrix inequalities (LMI) approach. Spacecraft Attitude Control:A Linear Matrix Inequality Approach presents solutions to spacecraft attitude control systems using an LNI approach. The book shows that a variety of problems can be reduced by a small number of quasiconvex or standard convex optimization problems that involve LMIs. Spacecraft Attitude Control:A Linear Matrix Inequality Approach solves problems for spacecraft attitude control systems using convex optimization, and specifically, through a linear matrix inequalities approach (LMI). High-precision 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 all uncertainties in the maneuvering process can be solved numerically. Through a mathematical presentation of attitude control systems, a model-like state-space can be developed, allowing the controller in question to be applied universally. 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 introduces spacecraft attitude control and robust systems, giving an extensive survey of current research, and helping researchers improve robust control performance. Presents a linear matrix inequality (LMI) approach to spacecraft attitude control Considers the control requirements of modern spacecraft Presents rigid and flexible spacecraft control systems with inherent uncertainties mathematically, leading to a model-like state-space Develops a variety of novel and robust controllers directly applicable to spacecraft control as well as extendable to other second-order systems Includes a systematic survey of recent research in spacecraft attitude control

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

Fundamentals of Space Systems was developed to satisfy two objectives: the first is to provide a text suitable for use in an advanced undergraduate or beginning graduate course in both space systems engineering and space system design. The second is to be a primer and reference book for space professionals wishing to broaden their capabilities to develop, manage the development, or operate space systems. The authors of the individual chapters are practicing engineers that have had extensive experience in developing sophisticated experimental and operational spacecraft systems in addition to having experience teaching the subject material. The text presents the fundamentals of all the subsystems of a spacecraft missions and includes illustrative examples drawn from actual experience to enhance the learning experience. It includes a chapter on each of the relevant major disciplines and subsystems including space systems engineering, space environment, astrodynamics, propulsion and flight mechanics, attitude determination and control, power systems, thermal control, configuration management and structures, communications, command and telemetry, data processing, embedded flight software, survuvability and reliability, integration and test, mission operations, and the initial conceptual design of a typical small spacecraft mission.

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.

This 1997 book explains basic theory of spacecraft dynamics and control and the practical aspects of controlling a satellite.

Modern Spacecraft Dynamics and ControlCourier Dover Publications

This book presents up-to-date concepts and design methods relating to space dynamics and control, including spacecraft attitude control, orbit control, and guidance, navigation, and control (GNC), summarizing the research advances in control theory and methods and engineering practice from Beijing Institute of Control Engineering over the years. The control schemes and systems based on these achievements have been successfully applied to remote sensing satellites, communication satellites, navigation satellites, new technology test satellites, Shenzhou manned spacecraft, Tianzhou freight spacecraft, Tiangong 1/2 space laboratories, Chang'e lunar explorers, and many other missions.

Further, the research serves as a guide for follow-up engineering developments in manned lunar engineering, deep space exploration, and on-orbit service missions. .