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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

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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).

Spacecraft Structures and Mechanisms describes the integral process of developing cost-effective, reliable structures and mechanical products for space programs.

Processes are defined, methods are described and examples are given. It has been written by 24 engineers in the space industry, who cover the themes of (1) ensuring a successful mission, and (2) reducing total cost

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through good designs and intelligent risk management. Topics include:

Introduction and requirements

(development process, requirements documentation, requirements

definition, space mission

environments); Analysis (statics,

dynamics and load analysis, fatigue and fracture mechanics, mechanics

of materials, strength analysis, heat transfer and thermal effects);

Verification and quality assurance

(verification planning, structural, mechanical and environmental

testing, quality assurance and

configuration control, compliance

documentation, structural reliability analysis, verification criteria -

factors of safety, margins of safety,

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fracture control, test options); Design (spacecraft configuration development, finite element analysis, mechanism development, designing for producibility, structural design, materials, designing to control loads, load cycles, sensitivity analysis); Final verification (model correlation, risk management, launch readiness reviews). For system engineers, mechanical designers, stress analysts, dynamics and load analysts, technical leads, program managers.

This book is based on class notes for a course in the MS program in Systems Engineering at Johns Hopkins University. The program was a cooperative effort between

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senior systems engineers from the Johns Hopkins University Applied Physics Laboratory and the Westinghouse Electric Company. The authors were part of the curriculum design team as well as members of the faculty.

Microengineering Aerospace Systems is a textbook tutorial encompassing MEMS (micro-electromechanical systems), nanoelectronics, packaging, processing, and materials characterization for developing miniaturized smart instruments for aerospace systems (i.e., ASIM application-specific integrated microinstrument), satellites, and satellite subsystems. Third in a

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series of Aerospace Press publications covering this rapidly advancing technology, this work presents fundamental aspects of the technology and specific aerospace systems applications through worked examples.

Space Vehicle Dynamics and Control

Satellite Orbits

Ames Research Center

LSC CPS1 () : LSC CPS1

Understanding Space 3e

The Space Environment and Its

Effects on Space Systems

Fundamentals of Spacecraft Attitude

Determination and Control

This book explores topics that are central to the field of

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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

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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

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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.

Fundamentals of Space Systems was developed to satisfy two objectives: the first is to provide a text suitable for

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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

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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,

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communications, command and telemetry, data processing, embedded flight software, survivability and reliability, integration and test, mission operations, and the initial conceptual design of a typical small spacecraft mission.

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

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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.

The highly successful Hubble Space Telescope was meant to change our view and understanding of the universe. Within weeks of its launch in 1990, however, the space community was shocked to find out that the primary mirror

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of the telescope was flawed. It was only the skills of scientists and engineers on the ground and the daring talents of astronauts sent to service the telescope in December 1993 that saved the mission. For over two decades NASA had developed the capabilities to service a payload in orbit. This involved numerous studies and the creation of a ground-based infrastructure to support the challenging missions. Unique tools and EVA hardware supported the skills developed in crew training that then enabled astronauts to

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complete a demanding series of spacewalks. Drawing upon first hand interviews with those closely involved in the project over thirty years ago this story explains the development of the servicing mission concept and the hurdles that had to be overcome to not only launch the telescope but also to mount the first servicing mission – a mission that restored the telescope to full working order three years after its launch, saved the reputation of NASA, and truly opened a new age in understanding of our place in

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space. This is not just a tale of space age technology, astronauts and astronomy. It is also a story of an audacious scientific vision, and the human ingenuity and determination to overcome all obstacles to make it possible. Hubble Space Telescope: From Concept to Success is a story of an international partnership, dedicated teamwork and a perfect blend of human and robotic space operations that will inspire people of all ages. The subsequent servicing missions that enabled the telescope to continue its

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scientific program beyond its 25th year in orbit are described in a companion volume Enhancing Hubble's Vision: Servicing a National Treasure.

LSC Human Spaceflight with Website

Moffett Field, California

Microengineering Aerospace Systems

The Hubble Space Telescope From Astronautics to

Cosmonautics

Space Vehicle Design

This text describes the relationship between mission operations and the other elements of the space mission. It

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defines the process that translates mission objectives and requirements into a viable mission operations concept. It describes how interplanetary, international, microsatellite, and crewed missions operate.

The revised and updated sixth edition of *em style="mso-bidi-font-style: normal;"*Satellite Communications Systems contains information on the most recent advances related to satellite communications systems, technologies, network architectures and new requirements of services and applications. The authors – noted experts on the topic – cover the state-of-the-art satellite

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communication systems and technologies and examine the relevant topics concerning communication and network technologies, concepts, techniques and algorithms. New to this edition is information on internetworking with the broadband satellite systems, more intensive coverage of Ka band technologies, GEO high throughput satellite (HTS), LEO constellations and the potential to support the current new broadband Internet services as well as future developments for global information infrastructure. The authors offer details on digital communication systems and broadband networks in order

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to provide high-level researchers and professional engineers an authoritative reference. The companion website provides slides for instructors to teach and for students to learn. In addition, the book is designed in a user-friendly format.

This is an introductory text in astronautics. It contains historical background and a discussion of space missions, space environment, orbits, atmospheric entry, spacecraft design, spacecraft subsystems, and space operations. It features section reviews summarizing key concepts, terms, and equations, and is extensively illustrated with many photos, figures, and

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examples Space law, politics, and economics This is a truly user-friendly, full-color text focused on understanding concepts and practical applications but written in a down-to-earth, engaging manner that painlessly helps you understand complex topics. It is laid out with multi-color highlights for key terms and ideas, reinforced with detailed example problems, and supported by detailed section reviews summarizing key concepts, terms, and equations. This book offers a unified presentation that does not discriminate between atmospheric and space flight. It

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demonstrates that 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, the work is primarily useful as a textbook for advanced undergraduate and beginning graduate-level students.

Code a Space Adventure Game!
Spacecraft Structures and

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Mechanisms

Models, Methods and Applications

Modeling and Simulation with MATLAB® and Simulink®

Space Mission Engineering - the New SMAD. Workbook

Low Earth Orbit Satellite Design

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

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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 experimen

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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.

Applied Space Systems Engineering is the 17th book produced by the US Air Force Academy's Space Technology Series team. The purpose of Applied Space Systems Engineering (ASSE) is to provide inspiration, processes, approaches, tools, and information for systems engineers that are leading the way in complex aerospace system design, development, and operation. An extensive author and editor team created this book based on a complete

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and rigorous set of systems engineer competencies rooted in the experiences and philosophies of seasoned space systems engineers from across the community. The “best of the best” performing system engineers have contributed their wealth of experience, successful tools and approaches, and lessons learned to this project. This book presents the “how-to” necessary to “systems engineer” complex aerospace-related projects, along with information to help the aspiring or current systems engineer achieve a higher level of understanding and performance. It’s geared to practitioners as they work through projects, but may also serve as a primary text or reference for graduate-level courses and development programs. Many aerospace-related case studies,

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examples, and lessons learned are spread throughout ASSE to provide historical insights and practical applications. A companion text, Applied Project Management for Space Systems, is also available. This book is a completely rewritten, updated, and expanded follow-on to the 3rd edition of Space mission analysis and design.

Space Mission EngineeringThe New SMAD

Systems Engineering: Principles And Practice

Cost-effective Space Mission Operations

Reducing Space Mission Cost

Spacecraft Systems Engineering

LSC CPS1 () : LSC CPS1 (USAFA)

Applied Systems Engineering - Space Mission Analysis and Design

This book provides a

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concise but broad overview of the engineering, science and flight history of planetary landers and atmospheric entry probes designed to explore the atmospheres and surfaces of other planets. It covers engineering aspects specific to such vehicles which are not usually treated in traditional spacecraft engineering texts. Examples are drawn from over thirty different lander and entry probe designs that have been

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used for lunar and planetary missions since the early 1960s. The authors provide detailed illustrations of many vehicle designs from different international space programs, and give basic information on their missions and payloads, irrespective of the mission's success or failure. Several missions are discussed in more detail to demonstrate the broad range of the challenges involved and the solutions implemented.

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This will form an important reference for professionals, academic researchers and graduate students involved in planetary science, aerospace engineering and space mission development.

One of the major challenges of modern space mission design is the orbital mechanics -- determining how to get a spacecraft to its destination using a limited amount of propellant. Recent missions such as Voyager

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and Galileo required gravity assist maneuvers at several planets to accomplish their objectives. Today's students of aerospace engineering face the challenge of calculating these types of complex spacecraft trajectories. This classroom-tested textbook takes its title from an elective course which has been taught to senior undergraduates and first-year graduate students for the past 22 years. The subject of orbital mechanics is

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developed starting from the first principles, using Newton's laws of motion and the law of gravitation to prove Kepler's empirical laws of planetary motion. Unlike many texts the authors also use first principles to derive other important results including Kepler's equation, Lambert's time-of-flight equation, the rocket equation, the Hill-Clohessy-Wiltshire equations of relative motion, Gauss' equations for the variation of the

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elements, and the Gauss and Laplace methods of orbit determination. The subject of orbit transfer receives special attention.

Optimal orbit transfers such as the Hohmann transfer, minimum-fuel transfers using more than two impulses, and non-coplanar orbital transfer are discussed.

Patched-conic interplanetary trajectories including gravity-assist maneuvers are the subject of an entire chapter and are

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particularly relevant to modern space missions. In recent decades, the number of satellites being built and launched into Earth's orbit has grown immensely, alongside the field of space engineering itself. This book offers an in-depth guide to engineers and professionals seeking to understand the technologies behind Low Earth Orbit satellites. With access to special spreadsheets that provide the key

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equations and relationships needed for mastering spacecraft design, this book gives the growing crop of space engineers and professionals the tools and resources they need to prepare their own LEO satellite designs, which is especially useful for designers of small satellites such as those launched by universities. Each chapter breaks down the various mathematics and principles underlying current spacecraft

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software and hardware designs.

Reducing Space Mission Cost is the first complete treatment of the technology, process, and problems in the most critical areas of modern spaceflight. The demand to reduce cost is unrelenting. This pioneering book addresses all aspects of this problem, including: Technology and processes for reducing cost Cost reduction in mission engineering, spacecraft design, manufacture,

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launch, and operations
Implementation methods
and problems The price
of reducing cost 10
detailed case studies of
what works in practice
in: Science missions
Interplanetary probes
Communications
spacecraft Test and
Applications missions
Beginning on the inside
front cover, this book
provides real cost data
on a variety of
missions, systems, and
subsystems. According to
the authors: `Reducing
mission cost is hard

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enough if you know what the real costs are, and virtually impossible if you don't.' This book challenges traditional methods, yet recognizes that all space programs are run to minimize cost within the rules under which they are built and flown. It provides practical recipes for reducing cost in both new and ongoing missions and discusses what works, what government can do to help, and what methods intended to reduce cost may be

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counterproductive and unintentionally increase cost. As shown on the inside rear cover, the case studies described in the book have reduced total mission cost by 80% to more than 90% with respect to projections by traditional cost methods. This book is a follow-on to the now standard text and reference, Space Mission Analysis and Design, also edited by Drs. Wertz and Larson. It is required reading for

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professionals, students, and managers in astronautics or space sciences and managers or scientists involved in space experiments. This book shows that reducing space mission cost, without reducing reliability, is as possible as it is important for the future of space exploration.

From Mission Design to Operations
The Space Environment
Fundamentals of Space Systems
Today's Space Elevator

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From Concept to Launch Fundamentals of Astrodynamics

This is an introductory text in astronautics. It contains historical background and a discussion of space missions, space environment, orbits, atmospheric entry, spacecraft design, spacecraft subsystems, and space operations. It features section reviews summarizing key concepts, terms, and equations, and is extensively illustrated with many photos, figures, and examples Space law, politics, and economics This is a truly user-friendly, full-color text focused on understanding concepts and practical applications but written in a down-to-earth, engaging manner that painlessly helps you understand complex topics. It is laid out with multi-color highlights

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for key terms and ideas, reinforced with detailed example problems, and supported by detailed section reviews summarizing key concepts, terms, and equations.

The only comprehensive text available on space propulsion for students and professionals in astronautics.

Two pioneers of space exploration, Robert Esnault-Pelterie and Ary Sternfeld, introduced the words 'astronautics' and 'cosmonautics,' respectively, into the scientific language. The origin of the term 'astronautics' is well documented. In contrast, the history of the word 'cosmonautics' remains poorly known. Ary Sternfeld is also largely forgotten. The fiftieth anniversary of the breakthrough to space, celebrated in 2007, makes it especially appropriate to remember those visionaries who

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paved the way to cosmos. The book tells the stories of 'astronautics' and 'cosmonautics' and describes a most unusual life journey of Ary Sternfeld "Human spaceflight: mission analysis and design" is for you if you manage, design, or operate systems for human spaceflight! It provides end-to-end coverage of designing human space systems for Earth, Moon, and Mars. If you are like many others, this will become the dog-eared book that is always on your desk -and used. The book includes over 800 rules of thumb and sanity checks that will enable you to identify key issues and errors early in the design processes. This book was written by group of 67 professional engineers, managers, and educators from industry, government, and academia that collectively share over 600 years of

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space-related experience! The team from the United States, Austria, Canada, France, Germany, Japan, and Russia worked for four-and-one-half years to capture industry and government best practices and lessons-learned from industry and government in an effort to baseline global conceptual design experience for human spaceflight. "Human spaceflight: mission analysis and design" provides a much-needed big-picture perspective that can be used by managers, engineers and students to integrate the myriad of elements associated with human spaceflight.

CubeSat Handbook
Human Spaceflight
The Logic of Microspace
Mission Geometry ; Orbit and Constellation Design and Management
Implications for Spacecraft Design -

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Revised and Expanded Edition
Space Mission Engineering
CubeSat Handbook: From Mission Design to Operations is the first book solely devoted to the design, manufacturing, and in-orbit operations of CubeSats. Beginning with an historical overview from CubeSat co-inventors Robert Twiggs and Jordi Puig-Suari, the book is divided into 6 parts with contributions from international experts in the area of small satellites and CubeSats. It covers topics such as standard interfaces, on-board & ground software,

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industry standards in terms of control algorithms and sub-systems, systems engineering, standards for AITV (assembly, integration, testing and validation) activities, and launch regulations. This comprehensive resource provides all the information needed for engineers and developers in industry and academia to successfully design and launch a CubeSat mission. Provides an overview on all aspects that a CubeSat developer needs to analyze during mission design and its

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realization Features practical examples on how to design and deal with possible issues during a CubeSat mission Covers new developments and technologies, including ThinSats and PocketQubeSats Following on from the hugely successful previous editions, the third edition of Spacecraft Systems Engineering incorporates the most recent technological advances in spacecraft and satellite engineering. With emphasis on recent developments in

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space activities, this new edition has been completely revised. Every chapter has been updated and rewritten by an expert engineer in the field, with emphasis on the bus rather than the payload. Encompassing the fundamentals of spacecraft engineering, the book begins with front-end system-level issues, such as environment, mission analysis and system engineering, and progresses to a detailed examination of subsystem elements which represent the core of spacecraft design -

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mechanical, electrical, propulsion, thermal, control etc. This quantitative treatment is supplemented by an appreciation of the interactions between the elements, which deeply influence the process of spacecraft systems design. In particular the revised text includes * A new chapter on small satellites engineering and applications which has been contributed by two internationally-recognised experts, with insights into small satellite systems engineering. * Additions to the mission analysis chapter,

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treating issues of aeromanoeuvring, constellation design and small body missions. In summary, this is an outstanding textbook for aerospace engineering and design students, and offers essential reading for spacecraft engineers, designers and research scientists. The comprehensive approach provides an invaluable resource to spacecraft manufacturers and agencies across the world. In the last year, the International Space Elevator Consortium assessed that

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basic technological needs can be met with current capabilities: and, each segment of the Space Elevator Transportation System is ready for engineering validation.

Because of the availability of a new material as a potential Space Elevator tether, the community strongly believes that a Space Elevator will be initiated in the near term.

Included in the book is a series of appendices that are tremendous references to the status of the space elevator today. Included are a lexicon of space elevator

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terms, over 750 references in the bibliography, short descriptions of eight ISEC year-long studies and two IAA 4-year studies on space elevators, as well as a summary of over 20 Architectural Notes covering the development of space elevator technologies. With the second edition of Space Mission Analysis and Design, two changes have been introduced in the Space Technology Library. Foremost among these is the introduction of the Space Technology Series as a part of the Space Technology

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Library. Dr. Wiley Larson of the US Air Force Academy and University of Colorado, Colorado Springs, will serve as Managing Editor for the Space Technology Series. This series is a cooperative effort of the Department of Defense, National Aeronautics and Space Administration, Department of Energy, and European Space Agency, coordinated by the US Air Force Academy. The sponsors intend to bring a number of books into the series to improve the literature base in the fundamentals of space

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technology, beginning with the current volume. Books which are not a part of the Space Technology Series, but which also represent a substantial contribution to the space technology literature, will still be published in the Space Technology Library. As always, we welcome suggestions and contributions from the aerospace community.

Orbital Mechanics
From Concept to Success
The New SMAD
Atmospheric and Space
Flight Dynamics

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Spacecraft Attitude Determination and Control
Space Propulsion Analysis and Design

"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.

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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

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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.

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Human Spaceflight: Mission Analysis and Design is essential if you manage, design, or operate systems for human spaceflight. This book provides a much-needed big-picture perspective that can be used by managers, engineers and students to integrate the myriad of elements associated with human spaceflight. With end-to-end coverage of designing human space systems for Earth, Moon, and Mars, Human Spaceflight spotlights key issues and possible problems to consider as part of the design process. Written by a group of 67 professional engineers, managers, and educators from industry,

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government, and academia, this book shares industry and government best practices as well as lessons learned from decades of experience. Topics include: space and surface environments, human factors, safety, orbits and trajectories, space station design, life support systems, thermal controls, guidance and navigation, power systems, robotics, and so much more. Changing the focus of the multibillion-dollar global aerospace business toward smaller, lower-cost spacecraft is not happening solely due to technical, managerial, financial or market motivations. Rick Fleeter's second book on the small, low-

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cost space programmes which are the fastest-growing segment of aerospace activity, gives the reader a keen understanding of the full spectrum of factors driving this profound change. The text then goes beyond engineering technologies and management techniques to envision the tantalizing prospects microspace has in store for the industry, its present markets and those of the future.

The breakup of the Space Shuttle Columbia as it reentered Earth's atmosphere on February 1, 2003, reminded the public--and NASA--of the grave risks posed to spacecraft by

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everything from insulating foam to space debris. Here, Alan Tribble presents a singular, up-to-date account of a wide range of less conspicuous but no less consequential environmental effects that can damage or cause poor performance of orbiting spacecraft. Conveying a wealth of insight into the nature of the space environment and how spacecraft interact with it, he covers design modifications aimed at eliminating or reducing such environmental effects as solar absorptance increases caused by self-contamination, materials erosion by atomic oxygen, electrical discharges due to

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spacecraft charging, degradation of electrical circuits by radiation, and bombardment by micrometeorites. This book is unique in that it bridges the gap between studies of the space environment as performed by space physicists and spacecraft design engineering as practiced by aerospace engineers. Planetary Landers and Entry Probes

Satellite Communications Systems

Mission Python

Space Mission Analysis and Design

Space Economics

Program a graphical adventure

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game in this hands-on, beginner-friendly introduction to coding in the Python language. Launch into coding with Mission Python, a space-themed guide to building a complete computer game in Python. You'll learn programming fundamentals like loops, strings, and lists as you build Escape!, an exciting game with a map to explore, items to collect, and tricky logic puzzles to solve. As you work through the book, you'll build exercises and mini-projects, like making a spacewalk simulator and creating an astronaut's safety checklist that will put your new Python skills to the test. You'll learn how to use Pygame Zero, a free resource that lets you add graphics and sound effects to your creations,

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and you'll get useful game-making tips, such as how to design fun puzzles and intriguing maps. Before you know it, you'll have a working, awesome game to stump your friends with (and some nifty coding skills, too!). You can follow this book using a Raspberry Pi or a Microsoft Windows PC, and the 3D graphics and sound effects you need are provided as a download. Teaching text developed by U.S. Air Force Academy and designed as a first course emphasizes the universal variable formulation. Develops the basic two-body and n-body equations of motion; orbit determination; classical orbital elements, coordinate transformations; differential correction; more. Includes

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***specialized applications to lunar
and interplanetary flight,
example problems, exercises.
1971 edition.***

***Understanding Space
Elements of Spacecraft Design
Spacecraft Systems Design and
Operations
Systems, Techniques and
Technology***