Spacecraft Attitude Dynamics Peter C Hughes

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Design and Global Analysis of Spacecraft Attitude Control Systems
Aerospace Engineering
Fundamental Spacecraft Dynamics and Control
Applications of Green's Functions in Science and Engineering
Spacecraft Attitude Dynamics
Flight mechanics estimation theory symposium 1995
Space Flight Dynamics
Deep Space Craft
Fundamentals of Spacecraft Attitude Determination and Control
Spacecraft Attitude Determination and Control
Flight Mechanics/estimation Theory Symposium 1988
Spacecraft Modeling, Attitude Determination, and Control
Flight Mechanics
Advances in Spacecraft Attitude Control
Statics of Deformable Solids
Spaceflight Dynamics
Flight Mechanics/Estimation Theory Symposium 1992
Spacecraft Dynamics and Control
Separation Processes
Spacecraft Dynamics and Control
Microsatellites as Research Tools
Spacecraft Attitude Control
Spacecraft Dynamics and Control
Foundations of Space Dynamics

HULL HARDY

Attitude Control of a Spacecraft with a Strapdown Inertial Reference System and Onboard Computer Krieger Publishing Company
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.
Spacecraft Attitude Dynamics Elsevier
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.
Equilibrium Analysis and Its Application to Attitude Control Systems Courier Corporation
For the highly accurate calculation of orbit and attitude dynamics for dedicated scientific satellite missions a multi-purpose tool is developed. The range of applications given by the modular approach including a diversity of models and tools allows spanning the bridge between multiple engineering and science tasks. Application includes all mission phases such as spacecraft design, system verification, disturbance estimation and science signal modeling. Its high gravitational detail faithfully reflecting Earth' gravity anomalies and comprehensive environmental modeling has made the simulator particularly useful for application to science missions aiming to measure very small signals that easily can be falsified by effects that are not quantified with high precision. A strong focus is also laid on highly accurate modeling for the resolution of coupling interaction in a multi-body dynamics system. The current application includes post-mission data analysis of the science mission Gravity Probe B for validation purpose. The verification with science data represents the ultimate test towards simulator reliability and accuracy. Zur hochgenauen Bahn- und Lageberechnung wissenschaftlicher Satellitenmissionen wird ein vielseitig verwendbares Simulationswerkzeug entwickelt. Die Simulationsbibliothek ist modular aufgebaut und enthält eine Vielzahl unterschiedlicher Modelle und Tools, so dass der Einsatzbereich breit aufgestellt zwischen ingenieurtechnischen und wissenschaftlichen Anwendungen liegt. Der Anwendungsbereich umfasst die Vorbereitung von Missionsphasen wie Satellitendesign, Systemverifikation, Störgrößenschätzung und Datenauswertung. Hochgenaue Umweltmodelle vor allem für die Schwerkraft, und die Mehrkörperdynamik, die kleinste Kopplungseffekte berücksichtigt, befähigen den Simulator zum Einsatz bei Wissenschaftsmissionen, deren sehr kleine Messgrößen durch standardmäßig vernachlässigte, aber vergleichsweise große Umwelt- und Kopplungseffekte verfälscht werden können. In der aktuellen Anwendung wird eine Nachsimulation von Gravity Probe B vorgenommen. Der Vergleich mit den Missionsdaten dient der Validierung der Mehrkörperdynamik hinsichtlich Genauigkeit und Zuverlässigkeit.
Flexible Spacecraft Dynamics, Control and Guidance Elsevier
Originally published: New York: McGraw-Hill, 1971. 2nd ed. Includes a new introduction.
Orbital Mechanics and Astrodynamics Springer
Classic text analyzes trajectories of aircraft, missiles, satellites, and spaceships in terms of gravitational forces, aerodynamic forces, and thrust. Topics include general principles of kinematics, dynamics, aerodynamics, propulsion; quasi-steady and non-steady flight; and applications. 1962 edition.
Thermal Stresses IV Courier Dover Publications
No theoretical technique exists yet that enables the engineer to completely determine the stability of practical complex spacecraft attitude control systems. In this dissertation, a stability approach is developed that utilizes a computer simulation in conjunction with theoretical techniques to locate the potentially troublesome regions of state space and explore their acceptability. It is shown in Part I that for general physical systems, x = f(x), all limit cycles are associated with equilibrium points that lie "inside" the limit cycles. Thus, if no equilibrium point exists in a region, then no limit cycle is contained in that region. Special properties of limit cycles and equilibrium points are discussed and illustrated. In Part II, equilibrium points are found analytically for spacecraft attitude control systems. A method is devised to determine stability near these equilibrium points. Then, instead of utilizing a uniform or random n-dimensional grid of computer initial conditions, a grid is concentrated around a few calculated points. Several practical examples of actual systems are presented. When control systems are viewed in this light, a high degree of confidence is gained from far fewer computer runs than previously needed.
Spacecraft Attitude Determination and Control Courier Corporation
This is the fourth volume of the handbook Thermal Stresses. Following the principles established when the first volume was published in 1986, the fourth volume consists of six separate chapters prepared by specialists in the field. Each chapter is devoted to a different topic in the area of Thermal Stresses. Many results have been published for the first time in Thermal Stresses IV. The exposition of the material is on the state-of-the art level, which should be appropriate for graduate students, researchers, and engineers specializing in the field of stress analysis. In most cases the material is presented with some historical perspective. A large number of references provided will allow the readers to augment their knowledge, after studying a particular chapter.
High Performance Simulation of Attitude and Translation Dynamics Cuvillier Verlag
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.
Courier Corporation
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.
Spacecraft Attitude, Dynamics and Control Springer Science & Business Media
Spacecraft Attitude DynamicsCourier Corporation
Chaos in Attitude Dynamics of Spacecraft Springer Science & Business Media
An introduction to orbital mechanics and spacecraft attitude dynamics Foundations of Space Dynamics offers an authoritative text that combines a comprehensive review of both orbital mechanics and dynamics. The author—a noted expert in the field—covers up-to-date topics including: orbital perturbations, Lambert's transfer, formation flying, and gravity-gradient stabilization. The text provides an introduction to space dynamics in its entirety, including important analytical derivations and practical space flight examples. Written in an accessible and concise style, Foundations of Space Dynamics highlights analytical development and rigor, rather than numerical solutions via ready-made computer codes. To enhance learning, the book is filled with helpful tables, figures, exercises, and solved examples. This important book: Covers space dynamics with a systematic and comprehensive approach Is designed to be a practical text filled with real-world examples Contains information on the most current applications Includes up-to-date topics from orbital perturbations to gravity- gradient stabilization Offers a deep understanding of space dynamics often lacking in other textbooks Written for undergraduate and graduate students and professionals in aerospace engineering, Foundations of Space Dynamics offers an introduction to the most current information on orbital mechanics and dynamics.
Proceedings of the ... American Control Conference Springer
"Well-written, thoughtfully prepared, and profusely illustrated, this text by the prominent experts provides a full exposition of fundamentals of solid mechanics and principles of mechanics, statics, and simple statically indeterminate systems. Additional topics include strain and stress in three-dimensional solids, elementary elasticity, stress-strain relations for plastic solids, and energy principles in solid continuum. "--
Spacecraft Attitude Determination and Control Spacecraft Attitude Dynamics
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.
Applied Mechanics Reviews Springer Nature
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.
Spacecraft Attitude Dynamics and Control Elsevier
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.
Design and Global Analysis of Spacecraft Attitude Control Systems John Wiley & Sons
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.
Aerospace Engineering Springer Science & Business Media
Deep Space Craft opens the door to interplanetary flight. It looks at this world from the vantage point of real operations on a specific mission, and follows a natural trail from the day-to-day working of this particular spacecraft, through the functioning of all spacecraft to the collaboration of the various disciplines to produce the results for which a spacecraft is designed. These results are of course mostly of a scientific nature, although a small number of interplanetary missions are also flown primarily to test and prove new engineering techniques. The author shows how, in order to make sense of all the scientific data coming back to Earth, the need for experiments and instrumentation arises, and follows the design and construction of the instruments through to their placement and testing on a spacecraft prior to launch. Examples are given of the interaction between an instrument’s science team and the mission’s flight team to plan and specify observations, gather and analyze data in flight, and finally present the results and discoveries to the scientific community. This highly focused, insider’s guide to interplanetary space exploration uses many examples of previous and current endeavors. It will enable the reader to research almost any topic related to spacecraft and to seek the latest scientific findings, the newest emerging technologies, or the current status of a favorite flight. In order to provide easy paths from the general to the specific, the text constantly refers to the Appendices. Within the main text, the intent is general familiarization and categorization of spacecraft and instruments at a high level, to provide a mental framework to place in context and understand any spacecraft and any instrument encountered in the reader’s experience. Appendix A gives illustrated descriptions of many interplanetary spacecraft, some earth-orbiters and ground facilities to reinforce the classification framework. Appendix B contains illustrated detailed descriptions of a dozen scientific instruments, including some ground-breaking engineering appliances that have either already been in operation or are poised for flight. Each instrument’s range of sensitivity in wavelengths of light, etc, and its physical principle(s) of operation is described. Appendix C has a few annotated illustrations to clarify the nomenclature of regions and structures in the solar system and the planets’ ring systems, and places the solar system in context with the local interstellar environment.
Fundamental Spacecraft Dynamics and Control Elsevier
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.
Applications of Green's Functions in Science and Engineering Springer Science & Business Media
A strapdown inertial reference system and an onboard digital computer can be used to change the attitude of a spacecraft over large angles in an arbitrary direction. A study was conducted with an advanced Orbiting Astronomical Observatory (OAO) using a three-axis control law previously proven globally stable. The control system can reorient the spacecraft to an arbitrary inertial attitude with a single command by operating the three momentum wheels simultaneously. Reorientation, therefore, becomes a simple extension of a hold or pointing mode. The time required for reorientation with this system is considerably shorter

than the time required for a series of single-axis slews. The spacecraft attitude and control law are continuously updated by the onboard computer's using information provided by the strapdown inertial reference system. The use of a computer and inertial reference system with characteristics of systems presently under development demonstrates the feasibility of orientation with such a reference system. The basic system is not limited to the OAO but may be adapted for other three-axis-stabilized spacecraft.

Spacecraft Attitude Dynamics John Wiley & Sons
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.