

Spacecraft Attitude And Orbit Control Textbook Princeton

Review of Earth Satellite combined attitude and orbit control systems Very High Pointing Accuracy Attitude and Orbit Control Systems Spacecraft Dynamics and Control Preliminary Design of a Lightsat Attitude and Orbit Control System Testing of Spacecraft Attitude and Orbit Control Systems Spacecraft Attitude and Orbit Control Preprints, Conference on Attitude and Orbit Control Systems Attitude and Orbit Control Systems Space Stations Flexible Spacecraft Dynamics, Control and Guidance Attitude and Orbit Control for Satellite Broadcasting Missions Scientific and Technical Aerospace Reports Very High Pointing Accuracy Attitude and Orbit Control Systems The Study of Very High Pointing Accuracy Attitude and Orbit Control Systems Spacecraft Attitude and Orbit Control Systems Testing Journal of Guidance, Control, and Dynamics Attitude and Orbit Control Systems Attitude and Orbit Control Systems Precise Autonomous Orbit Control in Low Earth Orbit Attitude and Orbit Control of Small Satellites for Autonomous Terrestrial Target Tracking A. G. Earl C. Philippe Yongchun Xie Scott Edie J. J. M. Prins Michael Paluszek Ernst Messerschmid Leonardo Mazzini C.A. Markland British Aerospace (Space Systems) T.D. Wood F. J. Sonnenschein C. Rowley C. Rowley Sergio De Florio Najmus Ibrahim

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in Low Earth Orbit Attitude and Orbit Control of Small Satellites for Autonomous Terrestrial Target Tracking A. G. Earl
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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

the design of space stations like the recently launched iss is a highly complex and interdisciplinary task this book describes component technologies system integration and the potential usage of space stations in general and of the iss in particular it so addresses students and engineers in space technology ernst messerschmid holds the chair of space systems at the university of stuttgart and was one of the first german astronauts

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

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the main purpose of this research is the analysis development and implementation of a precise autonomous orbit control system for a spacecraft in low earth orbit this thesis work represents a step forward in the theoretical formalization and implementation of an on board orbit maintenance system two main approaches are identified for the realization of an on board orbit control system the first is the reconsideration and further development of state of the art orbit control methods from the perspective of autonomy a step forward is then taken in the direction of the definition of a general and rigorous formalization of the autonomous orbit control problem the problem of the autonomous absolute orbit control is considered as a specific case of two spacecraft in formation in which one the reference is virtual and affected only by the earth s gravitational field a new parametrization the relative earth fixed elements analogous to the relative orbital elements used for formation control is introduced to describe the relative motion of the real and reference sub satellite points on the earth surface an extensive discussion is dedicated to the reference orbit selection and generation process and the analysis of the free motion of a spacecraft in low earth orbit the reference orbit defines the spacecraft s nominal trajectory designed to satisfy the mission requirements the actual orbit is kept within certain bounds defined with respect to the reference orbit the generation process of the reference orbit is dealt in detail as it is the fundamental starting point of the orbit control chain the free motion analysis is essential to understand the orbit perturbation environment which causes the deviation of the actual from the nominal trajectory the use of the precise orbit determination data of the missions prisma and terrasar x guarantee the reliability of the results of this analysis and the understanding of the orbit s perturbation environments at an altitude of 700 and 500 km this study helps the definition of a proper control strategy the control algorithms developed in the thesis can be divided into the two broad categories of analytical and numerical an analytical algorithm for the maintenance of a repeat track orbit is developed from the state of the art methods and new analytical formulations for the reference orbit acquisition under different constraints and requirements are presented the virtual formation method for the absolute orbit control is formalized by means of the relative earth fixed elements described previously the state space representation is used for the mathematical formulation of the problem a linear and a quadratic optimal regulators based on this model are designed for the in plane and out of plane absolute orbit control numerical simulations are performed for the validation of the control methods the test platform includes a very accurate

orbit propagator the flight software and allows the simulation of actuators and navigation errors the simulation results are evaluated from a performance and operational point of view in order to formulate a first conclusion about the advantages and disadvantages of the different control techniques the main differences between the considered analytical and numerical control methods are outlined the practical implementation of a precise autonomous orbit control system for a spacecraft in low earth orbit is then described in detail the on board guidance navigation and control software development implementation and testing of the prisma mission to which the author of this thesis contributed is described the attention is focused on the technological aspects implied by the realization of the autonomous orbit control system tested in flight with the autonomous orbit keeping experiment on prisma among the several innovative aspects of the flight software development some space is dedicated to the advanced software validation and testing realized on the formation flying test bed at dlr the german aerospace center which played a fundamental role in the realization of the prisma mission and its experiments finally the flight results of the autonomous orbit keeping experiment on the prisma mission a fundamental milestone of this research work are presented this in flight experiment took place in the summer of 2011 and demonstrated the capability of autonomous precise absolute orbit control using the analytical control method developed in this thesis

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