



# Astronautics: The Physics of Space Flight

*By Ulrich Walter*

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As a crewmember of the D-2 shuttle mission and a full professor of astronautics at the Technical University in Munich, Ulrich Walter is an acknowledged expert in the field. He is also the author of a number of popular science books on space flight. The second edition of this textbook is based on extensive teaching and his work with students, backed by numerous examples drawn from his own experience. With its end-of-chapter examples and problems, this work is suitable for graduate level or even undergraduate courses in space flight, as well as for professionals working in the space industry.

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### Editorial Review

#### Review

“This is an excellent book. . . Overall, however, this is an impressive book that I will have no hesitation recommending to undergraduates and graduates.” (*The Aeronautical Journal*, 19 March 2014)

“Everything a physicist could possibly want to know about the reality of space flight is here.” (*Contemporary Physics*, 6 December 2013)

#### From the Back Cover

Since the launch of the first spacecraft in 1957, space technology has transformed our daily lives by introducing innovations such as worldwide telecommunications, broadcasting, weather forecasting and navigation. Recent years have seen a revival in the field of space systems engineering and astronautics due to increased reliance on space infrastructure to provide communications and navigation services, not to mention ongoing endeavours in human and robotic space exploration.

Ulrich Walter, a former astronaut and expert on space, presents in this textbook a thorough introduction to the physical principles underlying spaceflight and space exploration. Starting with the fundamentals of rocket propulsion and rocket trajectories, the author continues with a discussion of orbital and interplanetary flight mechanics, followed by guidance and re-entry. Ulrich Walter provides an understanding and insight beyond the numeric solution of equations by developing an appreciation for fundamental concepts.

Moreover, he is not reluctant to study the possibility of the occurrence of life in supposed multidimensional universes based on the stability analysis of planetary orbits nor to investigate relativistic space travel á la Star Trek from a mathematical perspective.

This text is based on extensive teaching experience and work with students at the Technical University, Munich, and includes selected chapter-end examples and problems. The reader will learn how to solve a given problem using a network of formulas and astronautic relationships presented in the book. Astronautics is a textbook for graduate level courses such as Satellite Engineering and Space Systems Engineering as well as professionals working in space industry.

#### From the contents:

- Rocket Principles and Flight
- Thermal and Electric Propulsion
- Interplanetary Flight
- Ascent and Reentry
- Orbit Mechanics
- Orbit Perturbations
- Three-Body Problem
- Rigid Body Dynamics

#### About the Author

Ulrich Walter, born in Iserlohn, Germany, received his PhD in the field of solid state physics from the University of Cologne. After two post-doc positions at the Argonne National Laboratory, Chicago, Illinois, and the University of California at Berkley, California, he joined the German astronaut team and flew in 1993 on board the space shuttle Columbia on the STS-55 (Spacelab D-2) mission. From 1998 to 2003, he held various corporate positions at the IBM Research Center, Germany, and in 2003 accepted a professorship at the Institute of Astronautics, Technische Universität München, Germany. Professor Walter became known to a wider audience as presenter of MaxQ, a popular science show on German television, and is author of a

number of popular science books on spaceflight and research. Currently, the main focus of his scientific work is on satellite technology.

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