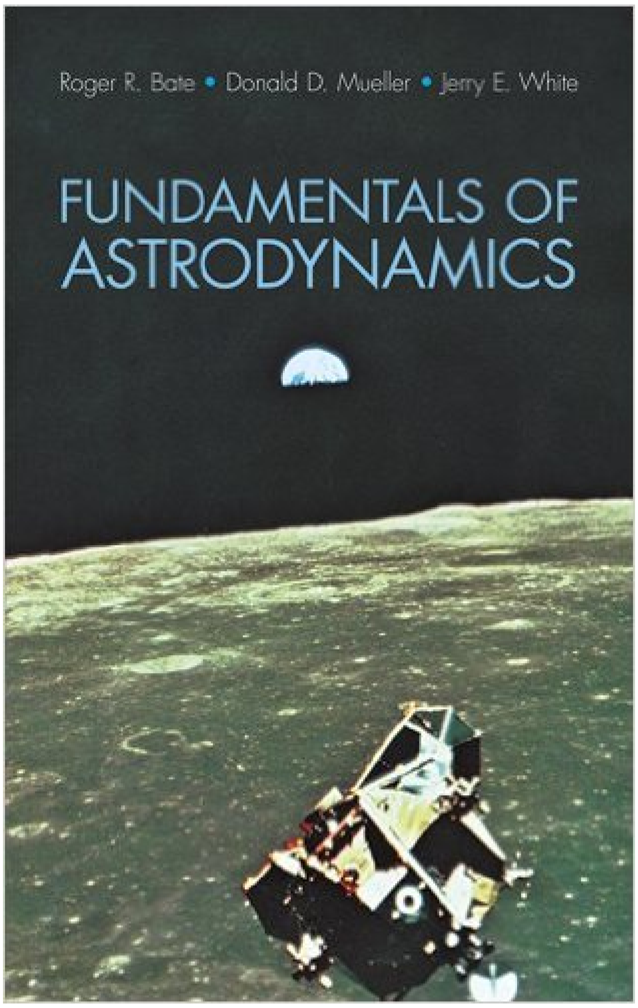
# Fundamentals Of Astrodynamics (Dover Books On Aeronautical Engineering)



## Synopsis

When the United States Air Force Academy began teaching astrodynamics to undergraduates majoring in astronautics or aerospace engineering, it found that the traditional approach to the subject was well over 100 years old. An entirely new text had to be evolved, geared to the use of high speed digital computers and actual current practice in the industry. Over the years the new approach was proven in the classrooms of the Academy; its students entering graduate engineering schools were found to possess a better understanding of astrodynamics than others. So pressing is the need for superior training in the aerospace sciences that the professor-authors of this text decided to publishÂ it for other institutions' use. This Dover edition is the result.The text is structured for teaching. Central emphasis is on use of the universal variable formulation, although classical methods are discussed. Several original unpublished derivations are included. A foundation for all that follows is the development of the basic two-body and n-body equations of motion; orbit determination is then treated, and the classical orbital elements, coordinate transformations, and differential correction. Orbital transfer maneuvers are developed, followed by time-of-flight with emphasis on the universal variable solution. The Kepler and Gauss problems are treated in detail. Two-body mechanics are applied to the ballistic missile problem, including launch error analysis and targeting on a rotating earth. Some further specialized applications are made to lunar and interplanetary flight, followed by an introduction to perturbation, special perturbations, integration schemes and errors, and analytic formulation of several common perturbations.Example problems are used frequently, while exercises at the end of each chapter include derivations and quantitative and qualitative problems. The authors suggest how to use the text for a first course in astrodynamics or for a two-course sequence.This major instructional tool effectively communicates the subject to engineering students in a manner found in no other textbook. Its efficiency has been thoroughly demonstrated. Dover feels privileged in joining with the authors to make its concepts and text matter available to other faculties.

## Book Information

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## Customer Reviews

While working for NASA/JPL back in the 1970's and 80's, I first used this book as a reference source while doing engineering support for radio astronomy experiments. I recall at the time wishing I'd know of the book a few years earlier while still at the Univ. of Arizona; while a student I would have found plenty of use for it.Recently I have returned to academia, and find myself making use some of its material for by my lower-division astronomy students. I've come to depend on it for its clearly-written explanations of the various coordinate systems, reference frames and obital dynamics. And I especially like the way it introduces n-body problems and the how they are affected by perturbations. For myself I even make some use of it when doing calindrical calculations.It is among a handful of reference sources that I find almost continuously useful in so many applications.

This book is a fairly complete overview of planetary mechanics, at least from the standpoint of the Newtonian formulation of the problem, for the authors do not use Lagrangian or Hamiltonian methods. The use of Hamiltonian formulation, via phase space constructions, sheds considerable light on the two-body and the N-body problems, but the reader interested in Hamiltonian mechanics will have to look elsewhere. Also, the authors do not discuss the presence of chaotic dynamics in orbital mechanics, nor are integrability issues discussed. In addition, the current debate over modifications of Newtonian mechanics is not included in the book, due to its time of publication. But if one wants a practical introduction to Newtonian orbital mechanics that also addresses numerical issues, this would be a good book to begin with. I would recommend the use of a symbolic programming language, such as Mathematica or Maple, to assist in the visualization of the orbits and in the routine computations if one were to use this book as an aid to teaching orbital mechanics. Another good feature of the book is the interjection of historical background and anecdotes at various places in the book. For example, one learns that it was Edmund Halley who was primarily responsible for bringing Newton's discoveries to the world. Newton's work remained idle for twenty years until Halley encouraged Newton to publish his explanation of planetary motion. The mechanics as outlined in this book is timeless and will continue to be learned by future generations of students as they take up the reigns of human exploration beyond the Moon to the entire solar system.

Affectionately referred to as BMW (from the author names), this book was the required text for my intro spaceflight mechanics course in college. Not only did I do just about every problem in the book (which helped me blow away the final), but over the next 15 years I kept coming back to it for quick reference. Some of my commercial products contain simple Kepler solvers and orbit integrators that began life in BMW. Compared to other books in this field, it's a deceptively easy read. But I know of at least one rocket destroyed by engineers ignorant of the basics in sections 9.5 and 9.6. Sure, it leaves out chaos and I really wish it used SI rather than imperial units (actually, it favors canonical units, a useful and units-agnostic concept). But BMW is the simplest, most intuitive intro to astrodynamics I've ever seen.

This work was written by three instructors at the USAF Academy for use as a textbook. It provides an excellent introduction to astrodynamics. A knowledge of calculus and linear algebra is required, but the derivations are quite reasonable. The diagrams are also very good, enabling the reader to visualize complex spatial orientations.The book's only weakness is its age. Several real-world examples are out-of-date, and the numerical analysis techniques do not reflect the current state-of-the-art.Nevertheless, this is the best book to start learning astrodynamics, and gives a solid foundation from which to study more advanced texts.

This book, the last word on astrodynamics (and the first, incidentally), covers every aspect of orbital mechanics, from Newton's gravitational equation to launch to transfer orbits to aberrational effects. It is clear and thorough. My only caveat is that it its old. A new edition done with the aid of computers, color ink, and more contemporary exercises would go a long way towards clearer understanding.

Ran into this one in grad school; has an excellent treatment of vector calculus in the appendix. Get this one if you are into orbital mechanics, guidance and nav. It's a short paperback type of book, easy to cart around in a briefcase. All steely-eyed missile men have this one.

If you want to know the science of Astrodynamics read this book. If you work with orbital analysis or orbital mechanics this book for you. For the beginners calculus, Algebra and some geometry knowledge are required otherwise the other aspect are well explained. I like the examples with its solution in this book, it force the reader to understand the principle especially if the subject sometimes is out of our daily vision. I have no problem following up this book, it simple and has all the principle and scientific logic you need to understand the science of space dynamics. It’s a very good bargain with its price.



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