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The Shaggy Steed of Physics - David Oliver 1994-06-24

The Shaggy Steed is an unassuming figure from Irish folklore who reveals himself as an inspiring teacher of the forces hidden in the universe. This book celebrates an unassuming bit of physics that also turns out to be an inspiring teacher. The two-body problem - the motion of two bodies bound by the inverse-square force of gravity and electricity - is the Shaggy Steed of physics, guiding the reader to an understanding of both the forces and the mathematical beauty hidden in the physical world.

Physics of Planetary Rings - Alexei M. Fridman 1999-07-02

This monograph presents the first comprehensive and detailed explanation for the planetary rings of Saturn, Uranus, Jupiter, and Neptune, exploring their striking, recently discovered structures such as narrow ringlets, spiral waves, and chain of vortices. This authoritative book is written in an accessible and engrossing style and is supplemented with an array of informative illustrations that will be of interest to professional and amateur astronomers, physicists, and students.

Methods of Celestial Mechanics - Gerhard Beutler 2004-11-19

G. Beutler's Methods of Celestial Mechanics is a coherent textbook for students as well as an excellent reference for practitioners. The first volume gives a thorough treatment of celestial mechanics and presents all the necessary mathematical details that a professional would need. The reader will appreciate the well-written chapters on numerical solution techniques for ordinary differential equations, as well as that on orbit determination. In the second volume applications to the rotation of earth and moon, to artificial earth satellites and to the planetary system are presented. The author addresses all aspects that are of importance in high-tech applications, such as the detailed gravitational fields of all planets and the earth, the oblateness of the earth, the radiation

pressure and the atmospheric drag. The concluding part of this monumental treatise explains and details state-of-the-art professional and thoroughly-tested software for celestial mechanics.

Mathematical Aspects of Classical and Celestial Mechanics - Vladimir I. Arnold 2006-10-06

The main purpose of the book is to acquaint mathematicians, physicists and engineers with classical mechanics as a whole, in both its traditional and its contemporary aspects. As such, it describes the fundamental principles, problems, and methods of classical mechanics, with the emphasis firmly laid on the working apparatus, rather than the physical foundations or applications. Chapters cover the n-body problem, symmetry groups of mechanical systems and the corresponding conservation laws, the problem of the integrability of the equations of motion, the theory of oscillations and perturbation theory.

Methods of Regularization for Computing Orbits in Celestial Mechanics - E. Stiefel 1967

Methods of Celestial Mechanics: Physical, mathematical, and numerical principles - G. Beutler 2005

Orbital and Celestial Mechanics - John Pascal Vinti 1998

An Introduction to Celestial Mechanics - Forest Ray Moulton 1914

Orbital Mechanics for Engineering Students - Howard D Curtis 2009-10-26

Orbital Mechanics for Engineering Students, Second Edition, provides an introduction to the basic concepts of space mechanics. These include vector kinematics in three dimensions; Newton's laws of motion and gravitation; relative motion; the vector-based solution of the classical two-body problem; derivation of Kepler's equations; orbits in three dimensions; preliminary orbit determination; and orbital maneuvers. The book also covers relative motion and the two-impulse rendezvous problem; interplanetary mission design using patched conics; rigid-body dynamics used to characterize the attitude of a space vehicle; satellite attitude dynamics; and the characteristics and design of multi-stage launch vehicles. Each chapter begins with an outline of key concepts and concludes with problems that are based on the material covered. This text is written for undergraduates who are studying orbital mechanics for the first time and have completed courses in physics, dynamics, and mathematics, including differential equations and applied linear algebra. Graduate students, researchers, and experienced practitioners will also find useful review materials in the book. NEW: Reorganized and improved discusions of coordinate systems, new discussion on perturbations and quarternions NEW: Increased coverage of attitude dynamics, including new Matlab algorithms and examples in chapter 10 New examples and homework problems

Space Debris - Heiner Klinkrad 2006-09-01

The future evolution of the debris environment will be forecast on the basis of traffic models and possible hazard mitigation practices. The text shows how large trackable objects will have re-entry pinpointed and predictions made on related risk assessment for possible ground impact. Models will also be described for meteoroids which are also a prevailing risk.

Applications of Modern Dynamics to Celestial Mechanics and Astrodynamics - V.G. Szebehely 1982-03-31

Proceedings of the NATO Advanced Study Institute, Cortina d'Ampezzo, Italy, August 2-14, 1981

Modern Celestial Mechanics - Alessandro Morbidelli 2002-05-16

In the last 20 years, researchers in the field of celestial mechanics have achieved spectacular results in their effort to understand the structure and evolution of our solar system. Modern Celestial Mechanics uses a solid theoretical basis to describe

recent results on solar system dynamics, and it emphasizes the dynamics of planets and of small bodies. To grasp celestial mechanics, one must comprehend the fundamental concepts of Hamiltonian systems theory, so this volume begins with an explanation of those concepts. Celestial mechanics itself is then considered, including the secular motion of planets and small bodies and mean motion resonances. Graduate students and researchers of astronomy and astrophysics will find Modern Celestial Mechanics an essential addition to their bookshelves.

Orbital Motion - A.E. Roy 2020-07-14

Long established as one of the premier references in the fields of astronomy, planetary science, and physics, the fourth edition of Orbital Motion continues to offer comprehensive coverage of the analytical methods of classical celestial mechanics while introducing the recent numerical experiments on the orbital evolution of gravitating masses and the astrodynamics of artificial satellites and interplanetary probes. Following detailed reviews of earlier editions by distinguished lecturers in the USA and Europe, the author has carefully revised and updated this edition. Each chapter provides a thorough introduction to prepare you for more complex concepts, reflecting a consistent perspective and cohesive organization that is used throughout the book. A noted expert in the field, the author not only discusses fundamental concepts, but also offers analyses of more complex topics, such as modern galactic studies and dynamical parallaxes. New to the Fourth Edition: * Numerous updates and reorganization of all chapters to encompass new methods * New results from recent work in areas such as satellite dynamics * New chapter on the Caledonian symmetrical n-body problem Extending its coverage to meet a growing need for this subject in satellite and aerospace engineering, Orbital Motion, Fourth Edition remains a top reference for postgraduate and advanced undergraduate students, professionals such as engineers, and serious amateur astronomers.

Lectures on Celestial Mechanics - Carl L. Siegel 1995-02-15

The present book represents to a large extent the translation of the German "Vorlesungen über Himmelsmechanik" by C. L. Siegel. The demand for a new edition and for an English translation gave rise to the present volume which, however, goes beyond a mere translation. To take account of recent work in this field a number of sections have been added, especially in the third chapter which deals with the stability theory. Still, it has not been attempted to give a complete presentation of the subject, and the basic prganization of Siegel's original book has not been altered. The emphasis lies in the development of results and analytic methods which are based on the ideas of H. Poincare, G. D. Birkhoff, A. Liapunov and, as far as Chapter I is concerned, on the work of K. F. Sundman and C. L. Siegel. In recent years the measure-theoretical aspects of mechanics have been revitalized and have led to new results which will not be discussed here. In this connection we refer, in particular, to the interesting book by V. I. Arnold and A. Avez on "Problemes Ergodiques de la Mecanique Classique", which stresses the interaction of ergodic theory and mechanics. We list the points in which the present book differs from the German text. In the first chapter two sections on the tri pie collision in the three body problem have been added by C. L. Siegel.

Nonlinear and Complex Dynamics - José António Tenreiro Machado 2011-08-28

Nonlinear Dynamics of Complex Systems describes chaos, fractal and stochasticities within celestial mechanics, financial systems and biochemical systems. Part I discusses methods and applications in celestial systems and new results in such areas as low energy impact dynamics, low-thrust planar trajectories to the moon and earth-to-halo transfers in the sun, earth and moon. Part II presents the dynamics of complex systems including bio-systems, neural systems, chemical systems and hydro-dynamical systems. Finally, Part III covers

economic and financial systems including market uncertainty, inflation, economic activity and foreign competition and the role of nonlinear dynamics in each.

Fundamentals of Celestial Mechanics - J. M. A. Danby 1962

Capture Dynamics and Chaotic Motions in Celestial Mechanics - Edward Belbruno 2004

This book describes a revolutionary new approach to determining low energy routes for spacecraft and comets by exploiting regions in space where motion is very sensitive (or chaotic). It also represents an ideal introductory text to celestial mechanics, dynamical systems, and dynamical astronomy. Bringing together wide-ranging research by others with his own original work, much of it new or previously unpublished, Edward Belbruno argues that regions supporting chaotic motions, termed weak stability boundaries, can be estimated. Although controversial until quite recently, this method was in fact first applied in 1991, when Belbruno used a new route developed from this theory to get a stray Japanese satellite back on course to the moon. This application provided a major verification of his theory, representing the first application of chaos to space travel. Since that time, the theory has been used in other space missions, and NASA is implementing new applications under Belbruno's direction. The use of invariant manifolds to find low energy orbits is another method here addressed. Recent work on estimating weak stability boundaries and related regions has also given mathematical insight into chaotic motion in the three-body problem. Belbruno further considers different capture and escape mechanisms, and resonance transitions. Providing a rigorous theoretical framework that incorporates both recent developments such as Aubrey-Mather theory and established fundamentals like Kolmogorov-Arnold-Moser theory, this book represents an indispensable resource for graduate students and researchers in the disciplines concerned as well as practitioners in fields such as aerospace engineering.

Methods in Astrodynamics and Celestial Mechanics - Raynor L. Duncombe 2014-12-03

Methods in Astrodynamics and Celestial Mechanics is a collection of technical papers presented at the Astrodynamics Specialist Conference held in Monterey, California, on September 16-17, 1965, under the auspices of the American Institute of Aeronautics and Astronautics and Institute of Navigation. The conference provided a forum for tackling some of the most interesting applications of the methods of celestial mechanics to problems of space engineering. Comprised of 19 chapters, this volume first treats the promising area of motion around equilibrium configurations. Following a discussion on limiting orbits at the equilateral centers of libration, the reader is introduced to the asymptotic expansion technique and its application to trajectories. Asymptotic representations for solutions to the differential equations of satellite theory are considered. The last two sections deal with orbit determination and mission analysis and optimization in astrodynamics. Error equations of inertial navigation as applied to orbital determination and guidance are evaluated, along with parameter hunting procedures and nonlinear optimal control problems with control appearing linearly .This book will be useful to practitioners in the fields of aeronautics, astronautics, and astrophysics.

Digital Satellite Navigation and Geophysics - Ivan G. Petrovski 2012-03-29

Bridge the gap between theoretical education and practical work experience with this hands-on guide to GNSS, which features: • A clear, practical presentation of GNSS theory, with emphasis on GPS and GLONASS • All the essential theory behind software receivers and signal simulators • Key applications in navigation and geophysics, including INS aiding, scintillation monitoring, earthquake studies and more • Physical explanations of various important phenomena, including the similarity of

code delay and phase advance of GNSS signals, and negative cross-correlation between scintillation intensity and phase variations. Whether you are a practising engineer, a researcher or a student, you will gain a wealth of insights from the authors' 25 years of experience. You can explore numerous practical examples and case studies and get hands-on user experience with a bundled real-time software receiver, signal simulator and a set of signal data, enabling you to create your own GNSS lab for research or study.

An Introduction to Celestial Mechanics - Richard Fitzpatrick 2012-06-28

A clear, concise introduction to all the major features of solar system dynamics, ideal for a first course.

Methods of Celestial Mechanics - Gerhard Beutler 2009-09-02

G. Beutler's Methods of Celestial Mechanics is a coherent textbook for students as well as an excellent reference for practitioners. The first volume gives a thorough treatment of celestial mechanics and presents all the necessary mathematical details that a professional would need. The reader will appreciate the well-written chapters on numerical solution techniques for ordinary differential equations, as well as that on orbit determination. In the second volume applications to the rotation of earth and moon, to artificial earth satellites and to the planetary system are presented. The author addresses all aspects that are of importance in high-tech applications, such as the detailed gravitational fields of all planets and the earth, the oblateness of the earth, the radiation pressure and the atmospheric drag. The concluding part of this monumental treatise explains and details state-of-the-art professional and thoroughly-tested software for celestial mechanics.

Satellite Orbits - Oliver Montenbruck 2012-12-06

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 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.

Introduction to Orbital Perturbations - James M. Longuski 2022-03-01

This textbook provides details of the derivation of Lagrange's planetary equations and of the closely related Gauss's variational equations, thereby covering a sorely needed topic in existing literature. Analytical solutions can help verify the results of numerical work, giving one confidence that his or her analysis is correct. The authors—all experienced experts in astrodynamics and space missions—take on the massive derivation problem step by step in order to help readers identify and understand possible analytical solutions in their own endeavors. The stages are elementary yet rigorous; suggested student research project topics are provided. After deriving the variational equations, the authors apply them to many interesting problems, including the Earth-Moon system, the effect of an oblate planet, the perturbation of Mercury's orbit due to General Relativity, and the perturbation due to atmospheric drag. Along the way, they introduce several useful techniques such as averaging, Poincaré's method of small parameters, and variation of parameters. In the end, this textbook will help students, practicing engineers, and professionals across the fields of astrodynamics, astronomy, dynamics, physics, planetary science, spacecraft missions, and others. “An extensive, detailed, yet still easy-to-follow presentation of the field of orbital perturbations.” - Prof. Hanspeter Schaub, Smead Aerospace Engineering Sciences Department, University of Colorado, Boulder “This book, based on decades of teaching experience, is an invaluable resource for aerospace engineering students and practitioners alike who need an in-depth

understanding of the equations they use." - Dr. Jean Albert Kéchichian, The Aerospace Corporation, Retired "Today we look at perturbations through the lens of the modern computer. But knowing the why and the how is equally important. In this well organized and thorough compendium of equations and derivations, the authors bring some of the relevant gems from the past back into the contemporary literature." - Dr. David A Vallado, Senior Research Astrodynamicist, COMSPOC "The book presentation is with the thoroughness that one always sees with these authors. Their theoretical development is followed with a set of Earth orbiting and Solar System examples demonstrating the application of Lagrange's planetary equations for systems with both conservative and nonconservative forces, some of which are not seen in orbital mechanics books." - Prof. Kyle T. Alfriend, University Distinguished Professor, Texas A&M University

The Dynamics of Natural Satellites of the Planets - Nikolay Emelyanov 2020-10-16

The Dynamics of Natural Satellites of the Planets is an accessible reference for understanding the celestial mechanics of planetary moons through the lens of both theory and observation. Based on decades of research by the author, the book utilizes state-of-the-art observations of the natural satellites in the solar system to establish models, measurements and calculations to better understand the theory of the satellite movement and dynamics. It presents an extensive set of study methods and results on the motion of natural satellites of the planets and includes reviews and references to related publication for further explanation. By relating observations to numerical theory, the book serves as a quick and comprehensive reference for applying the theory of orbital dynamics to observational data on orbits and physical properties of the natural satellites in order to formulate state-of-the-art explanations and models, particularly for determining the parameters of satellite motion. Combines astronomy and celestial mechanics, providing astrometric data from observations to inform methods and models for predicting natural satellite dynamics Includes both theory and observation in one place and presents new models based on observations Organized into small sections, each providing specific measurements, calculations or models, making it a quick and comprehensive reference

Linear and Regular Celestial Mechanics - Eduard L. Stiefel 1971

Methods of Regularization for Computing Orbits in Celestial Mechanics - 1967

Methods of Celestial Mechanics - Gerhard Beutler 2014-11-30

G. Beutler's Methods of Celestial Mechanics is a coherent textbook for students as well as an excellent reference for practitioners. The first volume gives a thorough treatment of celestial mechanics and presents all the necessary mathematical details that a professional would need. The reader will appreciate the well-written chapters on numerical solution techniques for ordinary differential equations, as well as that on orbit determination. In the second volume applications to the rotation of earth and moon, to artificial earth satellites and to the planetary system are presented. The author addresses all aspects that are of importance in high-tech applications, such as the detailed gravitational fields of all planets and the earth, the oblateness of the earth, the radiation pressure and the atmospheric drag. The concluding part of this monumental treatise explains and details state-of-the-art professional and thoroughly-tested software for celestial mechanics.

Jacobi Dynamics - V.I. Ferronsky 2011-04-11

In their approach to Earth dynamics the authors consider the fundamentals of Jacobi Dynamics (1987, Reidel) for two reasons. First, because satellite observations have proved that the Earth does not stay in hydrostatic equilibrium, which is the physical basis of today's treatment of geodynamics.

And secondly, because satellite data have revealed a relationship between gravitational moments and the potential of the Earth's outer force field (potential energy), which is the basis of Jacobi Dynamics. This has also enabled the authors to come back to the derivation of the classical virial theorem and, after introducing the volumetric forces and moments, to obtain a generalized virial theorem in the form of Jacobi's equation. Thus a physical explanation and rigorous solution was found for the famous Jacobi's equation, where the measure of the matter interaction is the energy. The main dynamical effects which become understandable by that solution can be summarized as follows: • the kinetic energy of oscillation of the interacting particles which explains the physical meaning and nature of the gravitation forces; • separation of the shell's rotation of a self-gravitating body with respect to the mass density; difference in angular velocities of the shell rotation; • continuity in changing the potential of the outer gravitational force field together with changes in density distribution of the interacting masses (volumetric center of masses); • the nature of the precession of the Earth, the Moon and satellites; the nature of the rotating body's magnetic field and the generation of the planet's electromagnetic field. As a final result, the creation of the bodies in the Solar System having different orbits was discussed. This result is based on the discovery that all the averaged orbital velocities of the bodies in the Solar System and the Sun itself are equal to the first cosmic velocities of their proto-parents during the evolution of their redistributed mass density. Audience The work is a logical continuation of the book Jacobi Dynamics and is intended for researchers, teachers and students engaged in theoretical and experimental research in various branches of astronomy (astrophysics, celestial mechanics and stellar dynamics and radiophysics), geophysics (physics and dynamics of the Earth's body, atmosphere and oceans), planetology and cosmogony, and for students of celestial, statistical, quantum and relativistic mechanics and hydrodynamics.

Methods of Celestial Mechanics - Gerhard Beutler 2006-03-30

G. Beutler's Methods of Celestial Mechanics is a coherent textbook for students as well as an excellent reference for practitioners. The first volume gives a thorough treatment of celestial mechanics and presents all the necessary mathematical details that a professional would need. The reader will appreciate the well-written chapters on numerical solution techniques for ordinary differential equations, as well as that on orbit determination. In the second volume applications to the rotation of earth and moon, to artificial earth satellites and to the planetary system are presented. The author addresses all aspects that are of importance in high-tech applications, such as the detailed gravitational fields of all planets and the earth, the oblateness of the earth, the radiation pressure and the atmospheric drag. The concluding part of this monumental treatise explains and details state-of-the-art professional and thoroughly-tested software for celestial mechanics.

Celestial Mechanics and Astrodynamics - Victor Szebehely 2014-09-30

Celestial Mechanics and Astrodynamics

An Introduction to the Mathematics and Methods of Astrodynamics - Richard H. Battin 1999

Solar System Dynamics - Carl D. Murray 2000-02-13

The Solar System is a complex and fascinating dynamical system. This is the first textbook to describe comprehensively the dynamical features of the Solar System and to provide students with all the mathematical tools and physical models they need to understand how it works. It is a benchmark publication in the field of planetary dynamics and destined to become a classic. Clearly written and well illustrated, Solar System Dynamics shows how a basic knowledge of the two- and three-body problems and perturbation theory can be combined to understand features as diverse as the tidal heating of Jupiter's moon Io, the origin of the Kirkwood

gaps in the asteroid belt, and the radial structure of Saturn's rings. Problems at the end of each chapter and a free Internet Mathematica® software package are provided. Solar System Dynamics provides an authoritative textbook for courses on planetary dynamics and celestial mechanics. It also equips students with the mathematical tools to tackle broader courses on dynamics, dynamical systems, applications of chaos theory and non-linear dynamics.

Essential Relativistic Celestial Mechanics - Victor Brumberg 2017-11-22

Essential Relativistic Celestial Mechanics presents a systematic exposition of the essential questions of relativistic celestial mechanics and their relation to relativistic astrometry. The book focuses on the comparison of calculated and measurable quantities that is of paramount importance in using general relativity as a necessary framework in the discussion of high-precision observations and for the construction of accurate dynamical ephemerides. It discusses the results of the general relativistic theory of motion of celestial bodies and describes the relativistic theory of astronomical reference frames, time scales, and the reduction of observations.

Celestial Mechanics and Astrodynamics: Theory and Practice - Pini Gurfil 2016-07-28

This volume is designed as an introductory text and reference book for graduate students, researchers and practitioners in the fields of astronomy, astrodynamics, satellite systems, space sciences and astrophysics. The purpose of the book is to emphasize the similarities between celestial mechanics and astrodynamics, and to present recent advances in these two fields so that the reader can understand the inter-relations and mutual influences. The juxtaposition of celestial mechanics and astrodynamics is a unique approach that is expected to be a refreshing attempt to discuss both the mechanics of space flight and the dynamics of celestial objects. “Celestial Mechanics and Astrodynamics: Theory and Practice” also presents the main challenges and future prospects for the two fields in an elaborate, comprehensive and rigorous manner. The book presents homogenous and fluent discussions of the key problems, rendering a portrayal of recent advances in the field together with some basic concepts and essential infrastructure in orbital mechanics. The text contains introductory material followed by a gradual development of ideas interweaved to yield a coherent presentation of advanced topics.

Methods of Celestial Mechanics - Gerhard Beutler 2004-11-19

G. Beutler's Methods of Celestial Mechanics is a coherent textbook for students as well as an excellent reference for practitioners. The first volume gives a thorough treatment of celestial mechanics and presents all the necessary mathematical details that a professional would need. The reader will appreciate the well-written chapters on numerical solution techniques for ordinary differential equations, as well as that on orbit determination. In the second volume applications to the rotation of earth and moon, to artificial earth satellites and to the planetary system are presented. The author addresses all aspects that are of importance in high-tech applications, such as the detailed gravitational fields of all planets and the earth, the oblateness of the earth, the radiation pressure and the atmospheric drag. The concluding part of this monumental treatise explains and details state-of-the-art professional and thoroughly-tested software for celestial mechanics.

The Analytical Foundations of Celestial Mechanics - Aurel Wintner 2014-06-18

With this 1941 monograph, Aurel Wintner joined Poincaré, Birkhoff, and others in placing celestial mechanics on a sound mathematical basis. The product of many years of work by the author, it remains an extremely valuable contribution to the literature of this field. Starting with a review of dynamical operations, the treatment advances to local and non-local questions, dynamical systems, the problem of two bodies and the problem of several bodies, and an introduction to the restricted

problem. Suitable for advanced undergraduates and graduate students of physics, the text is amply supplemented by a substantial section of notes and references in which a great deal of the historical literature from which it derives is discussed.

Adventures in Celestial Mechanics - Victor G. Szebehely 2008-07-11

A fascinating introduction to the basic principles of orbital mechanics It has been three hundred years since Isaac Newton first formulated laws to explain the orbits of the Moon and the planets of our solar system. In so doing he laid the groundwork for modern science's understanding of the workings of the cosmos and helped pave the way to the age of space exploration. Adventures in Celestial Mechanics offers students an enjoyable way to become acquainted with the basic principles involved in the motions of natural and human-made bodies in space. Packed with examples in which these principles are applied to everything from a falling stone to the Sun, from space probes to galaxies, this updated and revised Second Edition is an ideal introduction to celestial mechanics for students of astronomy, physics, and aerospace engineering. Other features that helped make the first edition of this book the text of choice in colleges and universities across North America include: * Lively historical accounts of important discoveries in celestial mechanics and the men and women who made them * Superb illustrations, photographs, charts, and tables * Helpful chapter-end examples and problem sets

Methods of Celestial Mechanics - Dirk Brouwer 2013-09-03

Methods of Celestial Mechanics provides a comprehensive background of celestial mechanics for practical applications. Celestial mechanics is the branch of astronomy that is devoted to the motions of celestial bodies. This book is composed of 17 chapters, and begins with the concept of elliptic motion and its expansion. The subsequent chapters are devoted to other aspects of celestial mechanics, including gravity, numerical integration of orbit, stellar aberration, lunar theory, and celestial coordinates. Considerable chapters explore the principles and application of various mathematical methods. This book is of value to mathematicians, physicists, astronomers, and celestial researchers.

The Foundations of Celestial Mechanics - George William Collins 1989

Instabilities in Dynamical Systems - V.G. Szebehely 1979-04-30

Proceedings of the NATO Advanced Study Institute, Cortina D'Ampezzo, Italy, July 30-August 12, 1978