Plasma Physics Via Computer Simulation Series In Plasma Physics

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High-resolution Simulations of Strongly Coupled Coulomb Systems with a Parallel Tree Code - Mathias Winkel 2013

Computer Simulation of Space Plasmas - T. Sato 1985-05-31
Computer simulation is now widely recognized as a powerful tool and useful method at the current stage of research in space plasma physics. The expected role of computer simulation is to bridge the existing gap between theories and experiments/observations and to give a profound physical insight into highly tangled and nonlinearly coupled space plasma phenomena. One of the goals of space plasma physics in 1980's and 1990's is to elucidate the quantitative causal relationships of global and local energy flows in space plasma environment and establish the space plasma physics via cooperative studies among three important elements of observations, theories and computer simulations. Based on such recognition, Dr. M. Ashour-Abdalla (UCLA/USA), Dr. R. Gendrin (CNET/FRANCE) and both of us met together at the 20th General Assembly of URSI at Washington D. C. in 1981 to discuss what we should do and what we could do, reaching a conclusion that it is time to establish an International School of Space Simulations (ISSS). The objectives of the ISSS thus organized are firstly to educate and stimulate graduate students and young sCientists, secondly to exchange information on updated simulation techniques and thirdly to have mutual discussions among observational, theoretical and simulational scientists in the field of space physics. The first ISSS were organized by Prof. P. Coleman, Prof. T. Obayashi, Dr. H. Okuda in addition to the above four members. The first ISSS was held at Kansai Seminar House in Kyoto from Nov. I to Nov. 12, 1982.

Proceedings of the Seventh SIAM Conference on Parallel Processing for Scientific Computing - David H. Bailey 1995-01-01
Proceedings -- Parallel Computing.

Space Plasma Simulation - Jörg Büchner 2003-04-09
The aim of this book is twofold: to provide an introduction for newcomers to state of the art computer simulation techniques in space plasma physics and an overview of current developments. Computer simulation has reached a stage where it can be a highly useful tool for guiding theory and for making predictions of space plasma phenomena, ranging from microscopic to global scales. The various articles are arranged, as much as possible, according to the - derlying simulation technique, starting with the technique that makes the least number of assumptions: a fully kinetic approach which solves the coupled set of Maxwell’s equations for the electromagnetic ?eld and the equations of motion for a very large number of charged particles (electrons and ions) in this ?eld. Clearly, this is also the computationally most demanding model. Therefore, even with present day high performance computers, it is the most

restrictive in terms of the space and time domain and the range of particle parameters that can be covered by the simulation experiments. It still makes sense, therefore, to also use models, which due to their simp- fying assumptions, seem less realistic, although the e?ect of these assumptions on the outcome of the simulation experiments needs to be carefully assessed.

Numerical Simulation of Plasmas - Y.N. Dnestrovskii 2012-12-06

This book is devoted to mathematical modeling of tokamak plasma. Since the appearance in 1982 of the first edition (in Russian), a considerable amount of experimental and theoretical material on tokamak research has been accumu lated. The new-generation devices, viz. , TFTR, JET and JT-60 were put into operation. The first experiments on these units have confirmed the correctness of the basic physical concepts underlying their construction. Experiments on plasma heating with the help of neutral beams and high-frequency (HF) waves on previous generation devices made it possible to obtain high-P plasmas. The number of "medium-size" tokamaks in operation has increased. New experi mental results and advances in the theory have led to more complicated and perfected models of high-temperature plasma. Rapid progress in computer hardware and software has played an important role in the further development of mathematical modeling. While preparing the English edition of the book, we have revised the text considerably. Several new models which have undergone significant advance ment in recent years are described. A section devoted to models of RF (radio frequency) current drive has been added to Chap. 2. The reduced magneto hydrodynamic (MHD) equations for high-P plasma are now considered in detail in Chap. 3. Chapter 4 contains the latest results on anomalous thermal conductivity, diffusion coefficient and pinching. Two new sections are added to Chap. 5.

Space Plasma Simulation - Jörg Büchner 2008-01-11

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Particle Interactions in High-Temperature Plasmas - Oliver James Pike 2017-08-17

This thesis makes two important contributions to plasma physics. The first is the extension of the seminal theoretical works of Spitzer and Braginskii, which describe the basics of particle interactions in plasma, to relativistic systems. Relativistic plasmas have long been studied in high-energy astrophysics and are becoming increasingly attainable in the laboratory. The second is the design of a new class of photon–photon collider, which is the first capable of detecting the Breit–Wheeler process. Though it offers the simplest way for light to be converted into matter, the process has never been detected in the 80 years since its theoretical prediction. The experimental scheme proposed here exploits the radiation used in inertial confinement fusion experiments and could in principle be implemented in one of several current-generation facilities.

Surface Flute Waves in Plasmas - Igor Girka 2022-04-26

This book presents a comprehensive theoretical study of the electromagnetic eigenwaves propagating perpendicular to the axis of symmetry in various cylindrical waveguide-structures filled with magneto-active plasma. It

is the second, updated and significantly expanded edition of our book “Surface Flute Waves in Plasmas. Theory and Applications”, published in 2014 in the “Springer Series on Atomic, Optical, and Plasma Physics”. First, the text is complemented by a study of the wave energy rotation around the axis of the waveguides. Second, excitation of these waves by an electron beam gyrating around the axis is investigated in detail. “Surface waves” means that these waves only propagate along plasma surfaces and not in uniform infinite plasmas. Their wave amplitudes decrease with going away from the plasma boundary into the plasma depth. “Flute” means that the axial wavenumbers kz of the waves in plasma cylinders are assumed to be zero, and the waves only propagate in azimuthal direction. In this case, the surfaces of constant density resemble fluted Greek columns. However, the presence of a small but finite kz can be taken into account by the method of successive approximations, using the theory of surface flute waves as zeroth approach. A variety of present applications of surface waves and possible future applications are also included. The book applies to both professionals dealing with physical and technological problems of confined plasmas and to graduate and post-graduate students specializing in the fíelds of electrodynamics, plasma physics and related applications.

Fundamentals of Plasma Physics - J. A. Bittencourt 2013-06-29

Fundamentals of Plasma Physics is a general introduction designed to present a comprehensive, logical and unified treatment of the fundamentals of plasma physics based on statistical kinetic theory, with applications to a variety of important plasma phenomena. Its clarity and completeness makes the text suitable for self-learning and for self-paced courses. Throughout the text the emphasis is on clarity, rather than formality, the various derivations are explained in detail and, wherever possible, the physical interpretations are emphasized. The mathematical treatment is set out in great detail, carrying out the steps which are usually left to the reader. The problems form an integral part of the text and most of them were designed in such a way as to provide a guideline, stating intermediate steps with answers.

Computational Plasma Physics - Toshi Tajima 2018-03-14

The physics of plasmas is an extremely rich and complex subject as the variety of topics addressed in this book demonstrates. This richness and complexity demands new and powerful techniques for investigating plasma physics. An outgrowth from his graduate course teaching, now with corrections, Tajima's text provides not only a lucid introduction to computational plasma physics, but also offers the reader many examples of the way numerical modeling, properly handled, can provide valuable physical understanding of the nonlinear aspects so often encountered in both laboratory and astrophysical plasmas. Included here are computational methods for modern nonlinear physics as applied to hydrodynamic turbulence, solitons, fast reconnection of magnetic fields, anomalous transports, dynamics of the sun, and more. The text contains examples of problems now solved using computational techniques including those concerning finite-size particles, spectral techniques, implicit differencing, gyrokinetic approaches, and particle simulation.

Fusion - Hans Wilhelmsson 1999-12-01

Journeying through fusion in the universe, Fusion: A Voyage Through the Plasma Universe discusses all aspects of fusion and how they relate to our universe. It also studies the attempts to produce fusion energy on Earth. The book addresses a wide range of topics from stars, galaxies, comets, pulsars, black holes, and quasars to the auroras, lightning, and fluorescent tubes. Interestingly, the author explores how artists and authors like Vincent van Gogh, Leonardo da Vinci, and Hannes Alfvén have been fascinated by cosmic phenomena that rely on fusion and plasmas. He discusses motions in plasma, such as flames, waves, and whirls similar to those that occur in water. The book also examines several other branches of science where parallels can be found with fusion plasmas, including ecological systems that provide only very short-term weather forecasts and the dramatic changes in the world economy with its explosive tendencies and sometimes catastrophic results. It briefly shows how these nonlinear phenomena are at the heart of modern fusion plasma theory.

Exascale Scientific Applications - Tjerk P.

Straatsma 2017-11-13
From the Foreword: "The authors of the chapters in this book are the pioneers who will explore the exascale frontier. The path forward will not be easy... These authors, along with their colleagues who will produce these powerful computer systems will, with dedication and determination, overcome the scalability problem, discover the new algorithms needed to achieve exascale performance for the broad range of applications that they represent, and create the new tools needed to support the development of scalable and portable science and engineering applications. Although the focus is on exascale computers, the benefits will permeate all of science and engineering because the technologies developed for the exascale computers of tomorrow will also power the petascale servers and terascale workstations of tomorrow. These affordable computing capabilities will empower scientists and engineers everywhere." — Thom H. Dunning, Jr., Pacific Northwest National Laboratory and University of Washington, Seattle, Washington, USA "This comprehensive summary of applications targeting Exascale at the three DoE labs is a must read." — Rio Yokota, Tokyo Institute of Technology, Tokyo, Japan "Numerical simulation is now a need in many fields of science, technology, and industry. The complexity of the simulated systems coupled with the massive use of data makes HPC essential to move towards predictive simulations. Advances in computer architecture have so far permitted scientific advances, but at the cost of continually adapting algorithms and applications. The next technological breakthroughs force us to rethink the applications by taking energy consumption into account. These profound modifications require not only anticipation and sharing but also a paradigm shift in application design to ensure the sustainability of developments by guaranteeing a certain independence of the applications to the profound modifications of the architectures: it is the passage from optimal performance to the portability of performance. It is the challenge of this book to demonstrate by example the approach that one can adopt for the development of applications offering performance portability in spite of the profound changes of the computing architectures." — Christophe Calvin, CEA, Fundamental Research Division, Saclay, France "Three editors, one from each of the High Performance Computer Centers at Lawrence Berkeley, Argonne, and Oak Ridge National Laboratories, have compiled a very useful set of chapters aimed at describing software developments for the next generation exa-scale computers. Such a book is needed for scientists and engineers to see where the field is going and how they will be able to exploit such architectures for their own work. The book will also benefit students as it provides insights into how to develop software for such computer architectures. Overall, this book fills an important need in showing how to design and implement algorithms for exa-scale architectures which are heterogeneous and have unique memory systems. The book discusses issues with developing user codes for these architectures and how to address these issues including actual coding examples.' — Dr. David A. Dixon, Robert Ramsay Chair, The University of Alabama, Tuscaloosa, Alabama, USA

Plasma Physics via Computer Simulation - C.K. Birdsall 2004-10-01
Divided into three main parts, the book guides the reader to an understanding of the basic concepts in this fascinating field of research. Part 1 introduces you to the fundamental concepts of simulation. It examines one-dimensional electrostatic codes and electromagnetic codes, and describes the numerical methods and analysis. Part 2 explores the mathematics and physics behind the algorithms used in Part 1. In Part 3, the authors address some of the more complicated simulations in two and three dimensions. The book introduces projects to encourage practical work Readers can download plasma modeling and simulation software — the ES1 program — with implementations for PCs and Unix systems along with the original FORTRAN source code. p-BodyText2Now available in paperback, Plasma Physics via Computer Simulation is an ideal complement to plasma physics courses and for self-study.

Plasma-Material Interaction in Controlled Fusion - Dirk Naujoks 2006-08-25
This book deals with the specific contact between the fourth state of matter, i.e. plasma,

and the first state of matter, i.e. a solid wall, in controlled fusion experiments. A comprehensive analysis of the main processes of plasma-surface interaction is given together with an assessment of the most critical questions within the context of general criteria and operation limits. It also contains a survey on other important aspects in nuclear fusion.

Principles of Plasma Physics - Nicholas A. Krall 1986

Plasma Astrophysics And Space Physics - Jörg Büchner 2012-12-06

In May 1998 a hundred renowned scientists from 20 different countries met at the Max-Planck-Institut für Aeronomie to communicate their latest results and ideas in astrophysical and space plasma, as a follow-up to previous similar meetings which were held in Varenna, Abastumai, Potsdam, Toki and Guaruja. The main papers emerging from this meeting are collected in this volume. They deal with fundamental plasma phenomena, particle and radiation processes in astrophysics and space physics as the origin of magnetic activity, the basic mechanisms of particle acceleration and plasma heating common to plasma in galaxies and at the sun as well as in planetary magnetospheres. New observational results from YOHKOH, SOHO and other missions are presented. Using these, the basic physical processes leading to coronal heating and solar/stellar wind acceleration are discussed. Other topics are the microphysics of shock waves and transport phenomena in collisionless plasmas and the physics of thin plasma boundaries. The volume also treats the ionic composition of plasma and dust in the Universe and their observability in the solar system. A CD-ROM is attached which adds a valuable multimedia component, illuminating results of observations, theory and simulations. Everyone interested in astrophysical plasmas, its radiation and charged particle aspects, and advanced or even beginning students will find references to nearly all modern aspects of plasma astrophysics and space physics as well as an overview of current research results.

Foundations of Plasma Physics for Physicists and Mathematicians - G. J. Pert 2021-03-29

A comprehensive textbook on the foundational principles of plasmas, including material on advanced topics and related disciplines such as optics, fluid dynamics, and astrophysics Foundations of Plasma Physics for Physicists and Mathematicians covers the basic physics underlying plasmas and describes the methodology and techniques used in both plasma research and other disciplines such as optics and fluid mechanics. Designed to help readers develop physical understanding and mathematical competence in the subject, this rigorous textbook discusses the underlying theoretical foundations of plasma physics as well as a range of specific problems, focused on those principally associated with fusion. Reflective of the development of plasma physics, the text first introduces readers to the collective and collisional behaviors of plasma, the single particle model, wave propagation, the kinetic effects of gases and plasma, and other foundational concepts and principles. Subsequent chapters cover topics including the hydrodynamic limit of plasma, ideal magneto-hydrodynamics, waves in MHD plasmas, magnetically confined plasma, and waves in magnetized hot and cold plasma. Written by an acknowledged expert with more than five decades' active research experience in the field, this authoritative text: Identifies and emphasizes the similarities and differences between plasmas and fluids Describes the different types of interparticle forces that influence the collective behavior of plasma Demonstrates and stresses the importance of coherent and collective effects in plasma Contains an introduction to interactions between laser beams and plasma Includes supplementary sections on the basic models of low temperature plasma and the theory of complex variables and Laplace transforms Foundations of Plasma Physics for Physicists and Mathematicians is the ideal textbook for advanced undergraduate and graduate students in plasma physics, and a valuable compendium for physicists working in plasma physics and fluid mechanics.

Computer Applications in Plasma Science and Engineering - Adam T. Drobot 2012-12-06

This volume, which contains 15 contributions, is based on a minicourse held at the 1987 IEEE Plasma Science Meeting. The purpose of the lectures in the course was to acquaint the

students with the multidisciplinary nature of computational techniques and the breadth of research areas in plasma science in which computation can address important physics and engineering design issues. These involve: electric and magnetic fields, MHD equations, chemistry, radiation, ionization etc. The contents of the contributions, written subsequent to the minicourse, stress important aspects of computer applications. They are: 1) the numerical methods used; 2) the range of applicability; 3) how the methods are actually employed in research and in the design of devices; and, as a compendium, 4) the multiplicity of approaches possible for any one problem. The materials in this book are organized by both subject and applications which display some of the richness in computational plasma physics.

Introduction to Complex Plasmas - Michael Bonitz 2012-10-13

Complex plasmas differ from traditional plasmas in many ways: these are low-temperature high pressure systems containing nanometer to micrometer size particles which may be highly charged and strongly interacting. The particles may be chemically reacting or be in contact with solid surfaces, and the electrons may show quantum behaviour. These interesting properties have led to many applications of complex plasmas in technology, medicine and science. Yet complex plasmas are extremely complicated, both experimentally and theoretically, and require a variety of new approaches which go beyond standard plasma physics courses. This book fills this gap presenting an introduction to theory, experiment and computer simulation in this field. Based on tutorial lectures at a very successful recent Summer Institute, the presentation is ideally suited for graduate students, plasma physicists and experienced undergraduates.

Computer Simulation Using Particles - R.W Hockney 2021-03-24

Computer simulation of systems has become an important tool in scientific research and engineering design, including the simulation of systems through the motion of their constituent particles. Important examples of this are the motion of stars in galaxies, ions in hot gas plasmas, electrons in semiconductor devices, and atoms in solids and liquids. The behavior of the system is studied by programming into the computer a model of the system and then performing experiments with this model. New scientific insight is obtained by observing such computer experiments, often for controlled conditions that are not accessible in the laboratory. Computer Simulation using Particles deals with the simulation of systems by following the motion of their constituent particles. This book provides an introduction to simulation using particles based on the NGP, CIC, and P3M algorithms and the programming principles that assist with the preparations of large simulation programs based on the OLYMPUS methodology. It also includes case study examples in the fields of astrophysics, plasmas, semiconductors, and ionic solids as well as more detailed mathematical treatment of the models, such as their errors, dispersion, and optimization. This resource will help you understand how engineering design can be assisted by the ability to predict performance using the computer model before embarking on costly and time-consuming manufacture.

Multicomponent and Multiscale Systems - Juergen Geiser 2015-08-21

This book examines the latest research results from combined multi-component and multi-scale explorations. It provides theory, considers underlying numerical methods and presents brilliant computational experimentation. Engineering computations featured in this monograph further offer particular interest to many researchers, engineers and computational scientists working in frontier modeling and applications of multicomponent and multiscale problems. Professor Geiser gives specific attention to the aspects of decomposing and splitting delicate structures and controlling decomposition and the rationale behind many important applications of multi-component and multi-scale analysis. Multicomponent and Multiscale Systems: Theory, Methods and Applications in Engineering also considers the question of why iterative methods can be powerful and more appropriate for well-balanced multiscale and multicomponent coupled nonlinear problems. The book is ideal for engineers and scientists working in theoretical and applied areas.

Numerical Methods for Hyperbolic and Kinetic Problems - Stéphane Cordier 2005
Hyperbolic and kinetic equations arise in a large variety of industrial problems. For this reason, the Summer Mathematical Research Center on Scientific Computing and its Applications (CEMRACS), held at the Center of International Research in Mathematics (CIRM) in Luminy, was devoted to this topic. During a six-week period, junior and senior researchers worked full time on several projects proposed by industry and academia. Most of this work was completed later on, and the present book reflects these results. The articles address modelling issues as well as the development and comparisons of numerical methods in different situations. The applications include multi-phase flows, plasma physics, quantum particle dynamics, radiative transfer, sprays, and aeroacoustics. The text is aimed at researchers and engineers interested in applications arising from modelling and numerical simulation of hyperbolic and kinetic problems.
Introduction to Plasma Physics and Controlled Fusion - Francis F. Chen 2013-03-09
TO THE SECOND EDITION In the nine years since this book was first written, rapid progress has been made scientifically in nuclear fusion, space physics, and nonlinear plasma theory. At the same time, the energy shortage on the one hand and the exploration of Jupiter and Saturn on the other have increased the national awareness of the important applications of plasma physics to energy production and to the understanding of our space environment. In magnetic confinement fusion, this period has seen the attainment 13 of a Lawson number nTE of 2 x 10 cm -3 sec in the Alcator tokamaks at MIT; neutral-beam heating of the PL T tokamak at Princeton to KTi = 6. 5 keV; increase of average ß to 3%-5% in tokamaks at Oak Ridge and General Atomic; and the stabilization of mirror-confined plasmas at Livermore, together with injection of ion current to near field-reversal conditions in the 2XIIß device. Invention of the tandem mirror has given magnetic confinement a new and exciting dimension. New ideas have emerged, such as the compact torus, surface-field devices, and the EßT mirror-torus hybrid, and some old ideas, such as the stellarator and the reversed-field pinch, have been revived. Radiofrequency heat ing has become a new star with its promise of dc current drive. Perhaps most importantly, great progress has been made in the understanding of the MHD behavior of toroidal plasmas: tearing modes, magnetic Vll Vlll islands, and disruptions.
Laser-Plasma Interactions - Dino A. Jaroszynski 2009-03-27
A Solid Compendium of Advanced Diagnostic and Simulation Tools Exploring the most exciting and topical areas in this field, Laser-Plasma Interactions focuses on the interaction of intense laser radiation with plasma. After discussing the basic theory of the interaction of intense electromagnetic radiation fields with matter, the book covers three applications of intense fields in plasma: inertial fusion, wakefield accelerators, and advanced radiation sources. Collecting contributions from a host of international experts, the book provides a thorough grounding in the fundamental concepts of the interaction of electromagnetic radiation with matter, before moving on to selected advanced topics from the field. It describes state-of-the-art diagnostic tools and experimental techniques used to study laser-plasma interactions as well as simulation tools for modeling these interactions. With a focus on current research trends, this book guides readers to the brink of the most stimulating challenges in the field. It also gives readers an appreciation of the underlying phenomena linking several applications.
Waves in Plasmas - Thomas H. Stix 1992-12-01
"Blurb & Contents" "The reader is treated to constantly refreshing and engaging commentary and opinion that always informs....As she depicts them, the problems of the universe are always fascinating and, most of all, they are alive and compelling." David DeVorkin, Sky & Telescope Virginia Trimble offers readers a fascinating and accessible tour of the stars. An astronomer with shared appointments in California and Maryland, the author ranges over a large portion of the universe as she discusses the search for life on other planets, how galaxies form, why stars explode and die, and the nature of the elusive dark matter in the universe. She also explains the astronomical significance of Cheeps' pyramid and leads the reader through scientific speculation about what and when the Star of

Bethlehem might have been. Throughout, Trimble points to the exciting unanswered questions that still perplex the field and considers the formidable tasks to be faced by the next generation of young astronomers.

Plasma Electronics - Toshiaki Makabe 2006-03-27

Without plasma processing techniques, recent advances in microelectronics fabrication would not have been possible. But beyond simply enabling new capabilities, plasma-based techniques hold the potential to enhance and improve many processes and applications. They are viable over a wide range of size and time scales, and can be used for deposition,

Computational Science — ICCS 2002 - Peter M.A. Sloot 2002-04-12

Computational Science is the scientific discipline that aims at the development and understanding of new computational methods and techniques to model and simulate complex systems. The area of application includes natural systems - such as biology environ mental and geo-sciences, physics, and chemistry - and synthetic systems such as electronics and financial and economic systems. The discipline is a bridge bet ween 'classical' computer science - logic, complexity, architecture, algorithm- mathematics, and the use of computers in the aforementioned areas. The relevance for society stems from the numerous challenges that exist in the various science and engineering disciplines, which can be tackled by advances made in this field. For instance new models and methods to study environmental issues like the quality of air, water, and soil, and weather and climate predictions through simulations, as well as the simulation-supported development of cars, airplanes, and medical and transport systems etc. Paraphrasing R. Kenway (R.D. Kenway, Contemporary Physics. 1994): 'There is an important message to scientists, politicians, and industrialists: in the future science, the best industrial design and manufacture, the greatest medical progress, and the most accurate environmental monitoring and forecasting will be done by countries that most rapidly exploit the full potential of computational science'. Nowadays we have access to high-end computer architectures and a large range of computing environments, mainly as a consequence of the enormous sti mulus from the various international programs on advanced computing, e.g.

Plasma Physics via Computer Simulation - C.K. Birdsall 2018-10-08

Divided into three main parts, the book guides the reader to an understanding of the basic concepts in this fascinating field of research. Part 1 introduces you to the fundamental concepts of simulation. It examines one-dimensional electrostatic codes and electromagnetic codes, and describes the numerical methods and analysis. Part 2 explores the mathematics and physics behind the algorithms used in Part 1. In Part 3, the authors address some of the more complicated simulations in two and three dimensions. The book introduces projects to encourage practical work Readers can download plasma modeling and simulation software — the ES1 program — with implementations for PCs and Unix systems along with the original FORTRAN source code. Now available in paperback, Plasma Physics via Computer Simulation is an ideal complement to plasma physics courses and for self-study.

Computer Simulation Using Particles - R. W. Hockney 2017-06-29

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ionic solids as well as more detailed mathematical treatment of the models, such as their errors, dispersion, and optimization. This resource will help you understand how engineering design can be assisted by the ability to predict performance using the computer model before embarking on costly and time-consuming manufacture.

Computational Methods in Plasma Physics - Stephen Jardin 2010-06-02

Assuming no prior knowledge of plasma physics or numerical methods, Computational Methods in Plasma Physics covers the computational mathematics and techniques needed to simulate magnetically confined plasmas in modern magnetic fusion experiments and future magnetic fusion reactors. Largely self-contained, the text presents the basic concepts neces

Computational Many-Particle Physics - Holger Fehske 2007-12-10

Looking for the real state of play in computational many-particle physics? Look no further. This book presents an overview of state-of-the-art numerical methods for studying interacting classical and quantum many-particle systems. A broad range of techniques and algorithms are covered, and emphasis is placed on their implementation on modern high-performance computers. This excellent book comes complete with online files and updates allowing readers to stay right up to date.

Introduction to Complex Plasmas - Michael Bonitz 2010-07-29

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Introduction to Plasma Dynamics - A. I. Morozov 2012-12-06

As the twenty-first century progresses, plasma technology will play an increasing role in our lives, providing new sources of energy, ion–plasma processing of materials, wave electromagnetic radiation sources, space plasma thrusters, and more. Studies of the plasma state of matter not only accelerate technological developments but also improve the understanding of natural phenomena. Beginning with an introduction to the characteristics and types of plasmas, Introduction to Plasma Dynamics covers the basic models of classical diffuse plasmas used to describe such phenomena as linear and shock waves, stationary flows, elements of plasma chemistry, and principles of plasma lasers. The author presents specific examples to demonstrate how to use the models and to familiarize readers with modern plasma technologies. The book describes structures of magnetic fields—one- and zero-dimensional plasma models. It considers single-, two-, and multi-component simulation models, kinetics and ionization processes, radiation transport, and plasma interaction with solid surfaces. The text also examines self-organization and general problems associated with instabilities in plasma systems. In addition, it discusses cosmic plasma dynamic systems, such as Earth’s magnetosphere, spiral nebulas, and plasma associated with the Sun. This text provides wide-range coverage of issues related to plasma dynamics, with a final chapter addressing advanced plasma technologies, including plasma generators, plasma in the home, space propulsion engines, and controlled thermonuclear fusion. It demonstrates how to approach the analysis of complex plasma systems, taking into account the diversity of plasma environments. Presenting a well-rounded introduction to plasma dynamics, the book takes into consideration the models of plasma phenomena and their relationships to one another as well as their applications.

Coupled Systems - Juergen Geiser 2014-02-14

Efficient Methods to Solve Complex Coupled Systems Coupled Systems: Theory, Models, and

Applications in Engineering explains how to solve complicated coupled models in engineering using analytical and numerical methods. It presents splitting multiscale methods to solve multiscale and multiphysics problems and describes analytical and numerical methods in time and space for evolution equations arising in engineering problems. The book discusses the effectiveness, simplicity, stability, and consistency of the methods in solving problems that occur in real-life engineering tasks. It shows how MATLAB® and Simulink® are used to implement the methods. The author also covers the coupling of separate, multiple, and logical scales in applications, including microscale, macroscale, multiscale, and multiphysics problems. Covering mathematical, algorithmic, and practical aspects, this book brings together innovative ideas in coupled systems and extends standard engineering tools to coupled models in materials and flow problems with respect to their scale dependencies and their influence on each time and spatial scale.

The Hybrid Multiscale Simulation Technology - Alexander S. Lipatov 2013-04-17

A comprehensive description of hybrid plasma simulation models providing a very useful summary and guide to the vast literature on this topic.

Turbulence in the Solar Wind - Roberto Bruno 2016-10-07

This book provides an overview of solar wind turbulence from both the theoretical and observational perspective. It argues that the interplanetary medium offers the best opportunity to directly study turbulent fluctuations in collisionless plasmas. In fact, during expansion, the solar wind evolves towards a state characterized by large-amplitude fluctuations in all observed parameters, which resembles, at least at large scales, the well-known hydrodynamic turbulence. This text starts with historical references to past observations and experiments on turbulent flows. It then introduces the Navier-Stokes equations for a magnetized plasma whose low-frequency turbulence evolution is described within the framework of the MHD approximation. It also considers the scaling of plasma and magnetic field fluctuations and the study of nonlinear energy cascades within the same framework. It reports observations of turbulence in the ecliptic and at high latitude, treating Alfvénic and compressive fluctuations separately in order to explain the transport of mass, momentum and energy during the expansion. Further, existing models are compared with direct observations in the heliosphere. The problem of self-similar and anomalous fluctuations in the solar wind is then addressed using tools provided by dynamical system theory and discussed on the basis of available models and observations. The book highlights observations of Yaglom's law in solar wind turbulence, which is one of the most important findings in fully developed turbulence and directly related to the long-lasting and still unsolved problem of solar wind plasma heating. Lastly, it includes a short chapter dedicated to the kinetic range of fluctuations, which has recently been receiving more attention from the space plasma community, since this is inherently related to turbulent energy dissipation and consequent plasma heating. It particularly focuses on the nature and role of the fluctuations populating this frequency range, and discusses several model predictions and recent observational findings in this context.

Controlled Fusion and Plasma Physics - Kenro Miyamoto 2006-10-23

Resulting from ongoing, international research into fusion processes, the International Tokamak Experimental Reactor (ITER) is a major step in the quest for a new energy source.The first graduate-level text to cover the details of ITER, Controlled Fusion and Plasma Physics introduces various aspects and issues of recent fusion research activ

Computer Simulation of Liquids - M. P. Allen 1989

Computer simulation is an essential tool in studying the chemistry and physics of liquids. Simulations allow us to develop models and to test them against experimental data. This book is an introduction and practical guide to the molecular dynamics and Monte Carlo methods.

High Performance Computing - Julian M. Kunkel 2017-10-18

This book constitutes revised selected papers from 10 workshops that were held as the ISC High Performance 2017 conference in Frankfurt, Germany, in June 2017. The 59 papers presented in this volume were carefully reviewed and

selected for inclusion in this book. They stem from the following workshops: Workshop on Virtualization in High-Performance Cloud Computing (VHPC) Visualization at Scale: Deployment Case Studies and Experience Reports International Workshop on Performance Portable Programming Models for Accelerators (P^3MA) OpenPOWER for HPC (IWOPH) International Workshop on Data Reduction for Big Scientific Data (DRBSD) International Workshop on Communication Architectures for HPC, Big Data, Deep Learning and Clouds at Extreme Scale Workshop on HPC Computing in a Post Moore's Law World (HCPM) HPC I/O in the Data Center (HPC-IODC) Workshop on Performance and Scalability of Storage Systems (WOPSSS) IXPUG: Experiences on Intel Knights Landing at the One Year Mark International Workshop on Communication Architectures for HPC, Big Data, Deep Learning and Clouds at Extreme Scale (ExaComm)

Reaction-Diffusion Problems in the Physics of Hot Plasmas - H Wilhelmsson 2000-01-01

The physics of hot plasmas is of great importance for describing many phenomena in the universe and is fundamental for the prospect of future fusion energy production on Earth. Nontrivial results of nonlinear electromagnetic effects in plasmas include the self-organization and self-formation in the plasma of structures compact in time and space. Th