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Originating with the pioneering works of P. Fatou and G. Julia, the subject of complex dynamics has seen great advances in recent years. Complex dynamical systems often exhibit rich, chaotic behavior, which yields attractive computer generated pictures, for example the Mandelbrot and Julia sets, which have done much to renew interest in the subject. This self-contained book discusses the major mathematical tools necessary for the study of complex dynamics at an advanced level. Complete proofs of some of the major tools are presented; some, such as the Bers-Royden theorem on holomorphic motions, appear for the very first time in book format. An appendix considers Riemann surfaces and Teichmüller theory. Detailing the very latest research, the book will appeal to graduate students and researchers working in dynamical systems and related fields. Carefully chosen exercises aid understanding and provide a glimpse of further developments in real and complex one-dimensional dynamics. Engineers around the world depend on MATLAB for its power, usability, and outstanding graphics capabilities. Yet too often, engineering students are either left on their own to acquire the background they need to use MATLAB, or they must learn the program concurrently within an advanced course. Both of these options delay students from solving realistic design problems, especially when they do not have a text focused on applications relevant to their field and written at the appropriate level of mathematics. Ideal for use as a short-course textbook and for self-study Elementary Mathematical and Computational Tools for Electrical and Computer Engineers Using MATLAB fills that gap. Accessible after just one semester of calculus, it introduces the many practical analytical and numerical tools that are essential to success both in future studies and in professional life. Sharply focused on the needs of the electrical and computer engineering communities, the text provides a wealth of relevant exercises and design problems. Changes in MATLAB's version 6.0 are included in a special addendum. The lack of skills in fundamental quantitative tools can seriously impede progress in one's engineering studies or career. By working through this text, either in a lecture/lab environment or by themselves, readers will not only begin mastering MATLAB, but they will also hone their analytical and computational skills to a level that will help them to enjoy and succeed in subsequent electrical and computer engineering pursuits.

Mathematical Tools for Physicists is a unique collection of 18 carefully reviewed articles, each one written by a renowned expert working in the relevant field. The result is beneficial to both advanced students as well as scientists at work; the former will appreciate it as a comprehensive introduction, while the latter will use it as a ready reference. The contributions range from fundamental methods right up to the latest applications, including: - Algebraic/ analytic / geometric methods - Symmetries and conservation laws - Mathematical modeling - Quantum computation The emphasis throughout is ensuring quick access to the information sought, and each article features: - an abstract - a detailed table of contents - continuous cross-referencing - references to the most relevant publications in the field, and - suggestions for further reading, both introductory as well as highly specialized. In addition, a comprehensive index provides easy access to the vast number of key words extending beyond the range of the headlines. Advanced Mathematical Tools for Control Engineers: Volume 1 provides a blend of Matrix and Linear Algebra Theory, Analysis, Differential Equations, Optimization, Optimal and Robust Control. It contains an advanced mathematical tool which serves as a fundamental basis for both instructors and students who study or actively work in Modern Automatic Control or in its applications. It is includes proofs of all theorems and contains many examples with solutions. It is written for researchers, engineers, and advanced students who wish to increase their familiarity with different topics of modern and classical mathematics related to System and Automatic Control Theories. Provides comprehensive theory of matrices, real, complex and functional analysis Provides practical examples of modern optimization methods that can be effectively used in variety of real-world applications Contains worked proofs of all theorems and propositions presented This graduate-level textbook is a detailed exposition of key mathematical tools in analysis aimed at students, researchers, and practitioners across science and engineering. Every topic covered has been specifically chosen because it plays a key role outside the field of pure mathematics. Although the treatment of each topic is mathematical in nature, and concrete applications are not delineated, the principles and tools presented are fundamental to exploring the computational aspects of physics and engineering. Readers are expected to have a solid understanding of linear algebra, in Rn and in general vector spaces. Familiarity with the basic concepts of calculus and real analysis, including Riemann integrals and infinite series of real or complex numbers, is also required. Distills key concepts from linear algebra, geometry, matrices, calculus, optimization, probability and statistics that are used in machine learning. The objective of this self-contained book is two-fold. First, the reader is introduced to the modelling and mathematical analysis used in fluid mechanics, especially concerning the Navier-Stokes equations which is the basic model for the flow of incompressible viscous fluids. Authors introduce mathematical tools so that the reader is able to use them for studying many other kinds of partial differential equations, in particular nonlinear evolution problems. The background needed are basic results in calculus, integration, and functional analysis. Some sections certainly contain more advanced topics than others. Nevertheless, the authors’ aim is that graduate or PhD students, as well as researchers who are not specialized in nonlinear analysis or in mathematical fluid mechanics, can find a detailed introduction to this subject. . This book is a guide for researchers and practitioners to the new frontiers of 3D shape analysis and the complex mathematical tools most methods rely on. The target reader includes students, researchers and professionals with an undergraduate mathematics background, who wish to understand the mathematics behind shape analysis. The authors begin with a quick review of basic concepts in geometry, topology, differential geometry, and proceed to advanced notions of algebraic topology, always keeping an eye on the application of the theory, through examples of shape analysis methods such as 3D segmentation, correspondence, and retrieval. A number of research solutions in the field come from advances in pure and applied mathematics, as well as from the re-reading of classical theories and their adaptation to the discrete setting. In a world where disciplines (fortunately) have blurred boundaries, the authors believe that this guide will help to bridge the distance between theory

and practice. Table of Contents: Acknowledgments / Figure Credits / About this Book / 3D Shape Analysis in a Nutshell / Geometry, Topology, and Shape Representation / Differential Geometry and Shape Analysis / Spectral Methods for Shape Analysis / Maps and Distances between Spaces / Algebraic Topology and Topology Invariants / Differential Topology and Shape Analysis / Reeb Graphs / Morse and Morse-Smale Complexes / Topological Persistence / Beyond Geometry and Topology / Resources / Bibliography / Authors' Biographies The new edition is significantly updated and expanded. This unique collection of review articles, ranging from fundamental concepts up to latest applications, contains individual contributions written by renowned experts in the relevant fields. Much attention is paid to ensuring fast access to the information, with each carefully reviewed article featuring cross-referencing, references to the most relevant publications in the field, and suggestions for further reading, both introductory as well as more specialized. While the chapters on group theory, integral transforms, Monte Carlo methods, numerical analysis, perturbation theory, and special functions are thoroughly rewritten, completely new content includes sections on commutative algebra, computational algebraic topology, differential geometry, dynamical systems, functional analysis, graph and network theory, PDEs of mathematical physics, probability theory, stochastic differential equations, and variational methods. Prolate Spheroidal Wave Functions (PSWFs) are the eigenfunctions of the bandlimited operator in one dimension. As such, they play an important role in signal processing, Fourier analysis, and approximation theory. While historically the numerical evaluation of PSWFs presented serious difficulties, the developments of the last fifteen years or so made them as computationally tractable as any other class of special functions. As a result, PSWFs have been becoming a popular computational tool. The present book serves as a complete, self-contained resource for both theory and computation. It will be of interest to a wide range of scientists and engineers, from mathematicians interested in PSWFs as an analytical tool to electrical engineers designing filters and antennas. This unique book complements traditional textbooks by providing a visual yet rigorous survey of the mathematics used in theoretical physics beyond that typically covered in undergraduate math and physics courses. The exposition is pedagogical but compact, and the emphasis is on defining and visualizing concepts and relationships between them, as well as listing common confusions, alternative notations and jargon, and relevant facts and theorems. Special attention is given to detailed figures and geometric viewpoints. Certain topics which are well covered in textbooks, such as historical motivations, proofs and derivations, and tools for practical calculations, are avoided. The primary physical models targeted are general relativity, spinors, and gauge theories, with notable chapters on Riemannian geometry, Clifford algebras, and fiber bundles. This book covers the theoretical problems of modeling electrical behavior of the interconnections encountered in everyday electronic products. The coverage shows the theoretical tools of waveform prediction at work in the design of a complex and high-speed digital electronic system. Scientists, research engineers, and postgraduate students interested in electromagnetism, microwave theory, electrical engineering, or the development of simulation tools software for high speed electronic system design automation will find this book an illuminating resource. In this book, topics such as algebra, trigonometry, calculus and statistics are brought to life through over 500 applications ranging from biology, physics and chemistry to astronomy, geography and music. With over 600 illustrations emphasizing the beauty of mathematics, Math Tools complements more theoretical textbooks on the market, bringing the subject closer to the reader and providing a useful reference to students. By highlighting the ubiquity of mathematics in practical fields, the book will appeal not only to students and teachers, but to anyone with a keen interest in mathematics and its applications. Designed to demonstrate the essential mathematical concepts—comprehensively and economically—without re-teaching basic material or laboring over superfluous ideas, this text locates the necessary information in a practical economics context. Utilizing clear exposition and dynamic pedagogical features, Mathematical Tools for Economics provides students with the analytical skills they need to better grasp their field of

study. A short introduction to mathematics for students of economics Demonstrates essential mathematical concepts necessary for economic analysis, such as matrix algebra and calculus, simultaneous linear equations, and concrete and discrete time Incorporates applications to econometrics and statistics, and includes computational exercises illustrating the methods and concepts discussed in the text Clear explanations and dynamic pedagogical features provide students with the analytical skills they need to better grasp their field of study. Mathematical Tools for Economics is supported by an instructor's manual featuring solutions, available at www.blackwellpublishing.com/turkington "This book teaches various analysis, research, and problem-solving methods in an easy-to-follow, practical manner"-- This book introduces matrix algebra to students in behavioral and administrative sciences. It clearly defines the relevance of the exercises to concerns within the business community and the social and behavioral sciences. Readers will gain a technical background for tackling applications-oriented multivariate texts. One-dimensional dynamics has developed in the last decades into a subject in its own right. Yet, many recent results are inaccessible and have never been brought together. For this reason, we have tried to give a unified ac count of the subject and complete proofs of many results. To show what results one might expect, the first chapter deals with the theory of circle diffeomorphisms. The remainder of the book is an attempt to develop the analogous theory in the non-invertible case, despite the intrinsic additional difficulties. In this way, we have tried to show that there is a unified theory in one-dimensional dynamics. By reading one or more of the chapters, the reader can quickly reach the frontier of research. Let us quickly summarize the book. The first chapter deals with circle diffeomorphisms and contains a complete proof of the theorem on the smooth linearizability of circle diffeomorphisms due to M. Herman, J.-C. Yoccoz and others. Chapter II treats the kneading theory of Milnor and Thurstonj also included are an exposition on Hofbauer's tower construction and a result on fuB multimodal families (this last result solves a question posed by J. Milnor). Real-life problems are often quite complicated in form and nature and, for centuries, many different mathematical concepts, ideas and tools have been developed to formulate these problems theoretically and then to solve them either exactly or approximately. This book aims to gather a collection of papers dealing with several different problems arising from many disciplines and some modern mathematical approaches to handle them. In this respect, the book offers a wide overview on many of the current trends in Mathematics as valuable formal techniques in capturing and exploiting the complexity involved in real-world situations. Several researchers, colleagues, friends and students of Professor María Luisa Menéndez have contributed to this volume to pay tribute to her and to recognize the diverse contributions she had made to the fields of Mathematics and Statistics and to the profession in general. She had a sweet and strong personality, and instilled great values and work ethics in her students through her dedication to teaching and research. Even though the academic community lost her prematurely, she would continue to provide inspiration to many students and researchers worldwide through her published work. Engineering is basically an application of mathematics and applied sciences to the solution of real world problems. In the majority of real-life and applied phenomena in engineering sciences and also other applied sciences, solving to applied problems events are inevitable. In order to develop engineering sciences and applied sciences, it is necessary to carefully study analytical and numerical methods for solving of all available problems in case of linear and nonlinear equations. It is of great importance to study nonlinearity; because almost all applied processes act nonlinearly, and on the other hand, nonlinear analysis of complex systems is one of the most important and complicated tasks, especially in engineering and applied sciences problems. The most important and fundamental step to analyze an engineering problem is to determine the equations governing the motion and dynamics of the problem unless investigating the problems is impossible. Since the equations governing the motion of the body or system determine the nature of its analysis, obtaining these the equations is of great importance. This is a companion textbook for an

introductory course in physics. It aims to link the theories and models that students learn in class with practical problem-solving techniques. In other words, it should address the common complaint that 'I understand the concepts but I can't do the homework or tests'. The fundamentals of introductory physics courses are addressed in simple and concise terms, with emphasis on how the fundamental concepts and equations should be used to solve physics problems. Mathematical Foundations for Signal Processing, Communications, and Networking describes mathematical concepts and results important in the design, analysis, and optimization of signal processing algorithms, modern communication systems, and networks. Helping readers master key techniques and comprehend the current research literature, the book offers a comprehensive overview of methods and applications from linear algebra, numerical analysis, statistics, probability, stochastic processes, and optimization. From basic transforms to Monte Carlo simulation to linear programming, the text covers a broad range of mathematical techniques essential to understanding the concepts and results in signal processing, telecommunications, and networking. Along with discussing mathematical theory, each self-contained chapter presents examples that illustrate the use of various mathematical concepts to solve different applications. Each chapter also includes a set of homework exercises and readings for additional study. This text helps readers understand fundamental and advanced results as well as recent research trends in the interrelated fields of signal processing, telecommunications, and networking. It provides all the necessary mathematical background to prepare students for more advanced courses and train specialists working in these areas. Mathematically rigorous monograph on wavelets, written specifically for nonspecialists. Places the reader at the forefront of current research. This volume was born from the experience of the authors as researchers and educators,whichsuggeststhatmanystudentsofdataminingarehandicapped in their research by the lack of a formal, systematic education in its mat- matics. The data mining literature contains many excellent titles that address the needs of users with a variety of interests ranging from decision making to p- tern investigation in biological data. However, these books do not deal with the mathematical tools that are currently needed by data mining researchers and doctoral students. We felt it timely to produce a book that integrates the mathematics of data mining with its applications. We emphasize that this book is about mathematical tools for data mining and not about data mining itself; despite this, a substantial amount of applications of mathematical c- cepts in data mining are presented. The book is intended as a reference for the working data miner. In our opinion, three areas of mathematics are vital for data mining: set theory,includingpartially orderedsetsandcombinatorics;linear algebra,with its many applications in principal component analysis and neural networks; and probability theory, which plays a foundational role in statistics, machine learning and data mining. Thisvolumeisdedicatedtothestudyofset-theoreticalfoundationsofdata mining. Two further volumes are contemplated that will cover linear algebra and probability theory. The ?rst part of this book, dedicated to set theory, begins with a study of functionsandrelations.Applicationsofthesefundamentalconceptstosuch-sues as equivalences and partitions are discussed. Also, we prepare the ground for the following volumes by discussing indicator functions, ?elds and?-?elds, and other concepts. This book provides a comprehensive introduction to various mathematical approaches to achieving high-quality software. An introduction to mathematics that is essential for sound software engineering is provided as well as a discussion of various mathematical methods that are used both in academia and industry. The mathematical approaches considered include: Z specification language Vienna Development Methods (VDM) Irish school of VDM (VDM) approach of Dijkstra and Hoare classical engineering approach of Parnas Cleanroom approach developed at IBM software reliability, and unified modelling language (UML). Additionally, technology transfer of the mathematical methods to industry is considered. The book explains the main features of these approaches and applies mathematical methods to solve practical problems. Written with both student and professional in mind, this book assists the reader in applying mathematical methods to

solve practical problems that are relevant to software engineers. Having the right answer doesn't guarantee understanding. This book helps physics students learn to take an informed and intuitive approach to solving problems. It assists undergraduates in developing their skills and provides them with grounding in important mathematical methods.Starting with a review of basic mathematics, the author presents a thorough analysis of infinite series, complex algebra, differential equations, and Fourier series. Succeeding chapters explore vector spaces, operators and matrices, multi-variable and vector calculus, partial differential equations, numerical and complex analysis, and tensors. Additional topics include complex variables, Fourier analysis, the calculus of variations, and densities and distributions. An excellent math reference guide, this volume is also a helpful companion for physics students as they work through their assignments. The objective of this self-contained book is two-fold. First, the reader is introduced to the modelling and mathematical analysis used in fluid mechanics, especially concerning the Navier-Stokes equations which is the basic model for the flow of incompressible viscous fluids. Authors introduce mathematical tools so that the reader is able to use them for studying many other kinds of partial differential equations, in particular nonlinear evolution problems. The background needed are basic results in calculus, integration, and functional analysis. Some sections certainly contain more advanced topics than others. Nevertheless, the authors' aim is that graduate or PhD students, as well as researchers who are not specialized in nonlinear analysis or in mathematical fluid mechanics, can find a detailed introduction to this subject. . This graduate-level textbook is a detailed exposition of key mathematical tools in analysis aimed at students, researchers, and practitioners across science and engineering. Every topic covered has been specifically chosen because it plays a key role outside the field of pure mathematics. Although the treatment of each topic is mathematical in nature, and concrete applications are not delineated, the principles and tools presented are fundamental to exploring the computational aspects of physics and engineering. Readers are expected to have a solid understanding of linear algebra, in Rn and in general vector spaces. Familiarity with the basic concepts of calculus and real analysis, including Riemann integrals and infinite series of real or complex numbers, is also required. The mathematical and statistical tools needed in the rapidly growing quantitative finance field With the rapid growth in quantitative finance, practitioners must achieve a high level of proficiency in math and statistics. Mathematical Methods and Statistical Tools for Finance, part of the Frank J. Fabozzi Series, has been created with this in mind. Designed to provide the tools needed to apply finance theory to real world financial markets, this book offers a wealth of insights and guidance in practical applications. It contains applications that are broader in scope from what is covered in a typical book on mathematical techniques. Most books focus almost exclusively on derivatives pricing, the applications in this book cover not only derivatives and asset pricing but also risk management—including credit risk management—and portfolio management. Includes an overview of the essential math and statistical skills required to succeed in quantitative finance Offers the basic mathematical concepts that apply to the field of quantitative finance, from sets and distances to functions and variables The book also includes information on calculus, matrix algebra, differential equations, stochastic integrals, and much more Written by Sergio Focardi, one of the world's leading authors in high-level finance Drawing on the author's perspectives as a practitioner and academic, each chapter of this book offers a solid foundation in the mathematical tools and techniques need to succeed in today's dynamic world of finance. This book presents an overview of fundamental concepts in mathematics and how they are applied to basic financial engineering problems, with the goal of teaching students to use mathematics and engineering tools to understand and solve financial problems. Part I covers mathematical preliminaries (set theory, linear algebra, sequences and series, real functions and analysis, numerical approximations and computations, basic optimization theory, and stochastic processes), and Part II addresses financial topics ranging from low- to high-risk investments (interest rates and value of money, bonds, dynamic asset modeling, portfolio theory and optimization, option pricing, and the

concept of hedging). Based on lectures for a master's program in financial engineering given by the author over 12 years at the University of Southern California, Mathematics and Tools for Financial Engineering contains numerous examples and problems, establishes a strong general mathematics background and engineering modeling techniques in a pedagogical fashion, and covers numerical techniques with applications to solving financial problems using different software tools. This textbook is intended for graduate and advanced undergraduate students in finance or financial engineering and is useful to readers with no prior knowledge in finance who want to understand some basic mathematical tools and theories associated with financial engineering. It is also appropriate as an overview of many mathematical concepts and engineering tools relevant to courses on numerical analysis, modeling and data science, numerical optimization, and approximation theory. Mathematical Tools for Physicists is a unique collection of 18 carefully reviewed articles, each one written by a renowned expert working in the relevant field. The result is beneficial to both advanced students as well as scientists at work; the former will appreciate it as a comprehensive introduction, while the latter will use it as a ready reference. The contributions range from fundamental methods right up to the latest applications, including: - Algebraic/ analytic / geometric methods - Symmetries and conservation laws - Mathematical modeling - Quantum computation The emphasis throughout is ensuring quick access to the information sought, and each article features: - an abstract - a detailed table of contents - continuous cross-referencing - references to the most relevant publications in the field, and - suggestions for further reading, both introductory as well as highly specialized. In addition, a comprehensive index provides easy access to the vast number of key words extending beyond the range of the headlines. Uses geological examples to illustrate mathematical ideas. Contains a large number of worked examples, and problems for students to attempt themselves. Answers to all the questions are given at the end of the book. This book puts forward a new role for mathematics in the natural sciences. In the traditional understanding, a strong viewpoint is advocated, on the one hand, according to which mathematics is used for truthfully expressing laws of nature and thus for rendering the rational structure of the world. In a weaker understanding, many deny that these fundamental laws are of an essentially mathematical character, and suggest that mathematics is merely a convenient tool for systematizing observational knowledge. The position developed in this volume combines features of both the strong and the weak viewpoint. In accordance with the former, mathematics is assigned an active and even shaping role in the sciences, but at the same time, employing mathematics as a tool is taken to be independent from the possible mathematical structure of the objects under consideration. Hence the tool perspective is contextual rather than ontological. Furthermore, tool-use has to respect conditions like suitability, efficacy, optimality, and others. There is a spectrum of means that will normally differ in how well they serve particular purposes. The tool perspective underlines the inevitably provisional validity of mathematics: any tool can be adjusted, improved, or lose its adequacy upon changing practical conditions. Mathematical Tools for Changing Scale in the Analysis of Physical Systems presents a new systematic approach to changing the spatial scale of the differential equations describing science and engineering problems. It defines vectors, tensors, and differential operators in arbitrary orthogonal coordinate systems without resorting to conceptually difficult Riemmann-Christoffel tensor and contravariant and covariant base vectors. It reveals the usefulness of generalized functions for indicating curvilineal, surficial, or spatial regions of integration and for transforming among these integration regions. These powerful mathematical tools are harnessed to provide 128 theorems in tabular format (most not previously available in the literature) that transform time-derivative and del operators of a function at one scale to the corresponding operators acting on the function at a larger scale. Mathematical Tools for Changing Scale in the Analysis of Physical Systems also provides sample applications of the theorems to obtain continuum balance relations for arbitrary surfaces, multiphase systems, and problems of reduced dimensionality. The mathematical techniques and tabulated theorems ensure the book will be an invaluable

analysis tool for practitioners and researchers studying balance equations for systems encountered in the fields of hydraulics, hydrology, porous media physics, structural analysis, chemical transport, heat transfer, and continuum mechanics. Just like how you can't build a great building on a weak foundation, in order to nurture the great minds of the future, a better grasp on fundamentals is needed. Fundamentals of Basic Mathematical Tools (Class I-VIII) provides students with all the resources required to build a better grasp on mathematics. This booklet includes a detailed explanation of the basic concepts of mathematics such as multiplication/addition of signs, solving signed ratios, moving variables across the equal to sign in equations, discussion on roman numerals, conversion between units, solving for trigonometric ratios and many other areas which children find troublesome. Mathematics is perceived to be tough by kids but all they need is a better understanding of the basic concepts involved in the subject. The main objective of this book is to encourage students to pursue mathematics in higher education by helping them understand their fundamentals properly. This book is an exploration of tools and mathematics and issues in mathematics education related to tool use. The book has five parts. The first part reflects on doing a mathematical task with different tools, followed by a mathematician's account of tool use in his work. The second considers prehistory and history: tools in the development from ape to human; tools and mathematics in the ancient world; tools for calculating; and tools in mathematics instruction. The third part opens with a broad review of technology and intellectual trends, circa 1970, and continues with three case studies of approaches in mathematics education and the place of tools in these approaches. The fourth part considers issues related to mathematics instructions: curriculum, assessment and policy; the calculator debate; mathematics in the real world; and teachers' use of technology. The final part looks to the future: task and tool design and new forms of activity via connectivity and computer games. A paperback edition of successful and well reviewed 1995 graduate text on applied mathematics for engineers. This book explains how to translate biological assumptions into mathematics to construct useful and consistent models, and how to use the biological interpretation and mathematical reasoning to analyze these models. It shows how to relate models to data through statistical inference, and how to gain important insights into infectious disease dynamics by translating mathematical results back to biology. This textbook, suitable for an early undergraduate up to a graduate course, provides an overview of many basic principles and techniques needed for modern data analysis. In particular, this book was designed and written as preparation for students planning to take rigorous Machine Learning and Data Mining courses. It introduces key conceptual tools necessary for data analysis, including concentration of measure and PAC bounds, cross validation, gradient descent, and principal component analysis. It also surveys basic techniques in supervised (regression and classification) and unsupervised learning (dimensionality reduction and clustering) through an accessible, simplified presentation. Students are recommended to have some background in calculus, probability, and linear algebra. Some familiarity with programming and algorithms is useful to understand advanced topics on computational techniques. This mathematical reference for theoretical physics employs common techniques and concepts to link classical and modern physics. It provides the necessary mathematics to solve most of the problems. Topics include the vibrating string, linear vector spaces, the potential equation, problems of diffusion and attenuation, probability and stochastic processes, and much more. 1972 edition.