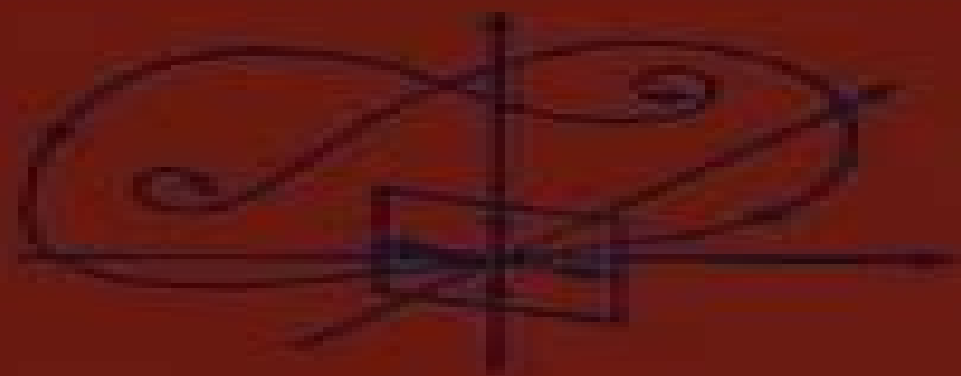


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Volume 196

Alternative Mathematical Theory *of* Non-equilibrium Phenomena

Dieter Straub



Alternative Mathematical Theory Of Non Equilibrium Phenomena

Arthur James Wells



Alternative Mathematical Theory Of Non Equilibrium Phenomena:

Alternative Mathematical Theory of Non-equilibrium Phenomena Dieter Straub, 1996-10-09 Alternative Mathematical Theory of Non equilibrium Phenomena presents an entirely new theoretical approach to complex non equilibrium phenomena especially Gibbs Falk thermodynamics and fluid mechanics This innovative new theory allows for inclusion of all state variables and introduces a new vector dissipation velocity which leads to useful restatements of momentum the Second Law and tensors for the laws of motion friction and heat conduction This application oriented text is relatively self contained and is an excellent guide book for engineers with a strong interest in fundamentals or for professionals using applied mathematics and physics in engineering applications This book emphasizes macroscopic phenomena focusing specifically on gaseous states though relations to liquid and crystalline states are also considered The author presents a new Alternative Continuum Theory of Compressible Fluids AT which provides a qualitative description of the subject in predominantly physical terms minimizing the mathematical premises The methodology discussed has applications in a wide range of fields outside of physics in areas including General System Theory Theoretical Economics and Biophysics and Medicine Presents the first theory capable of handling non equilibria phenomena Offers a unified theory of all branches of macroscopic physics Considers a consistent and uniform view of reality supported by modern mathematics leading to results different than those produced by classical theories Results in a change of paradigms in physics engineering and natural philosophy

Nonequilibrium Thermodynamics Yasar Demirel, 2002-11-22 The book begins with a brief review of equilibrium systems and transport and rate processes then covers the following areas theory of nonequilibrium thermodynamics dissipation function entropy and exergy analysis and case studies on using the second law of thermodynamics economic impact of the nonequilibrium thermodynamics theory analysis of transport and rate processes membrane transport dissipative structures and biological systems and other thermodynamic approaches and extended nonequilibrium thermodynamics Summarizes new applications of thermodynamics as tools for design and optimisation Covers second law and exergy analysis for sustainable development Promotes understanding of the coupled phenomena of natural processes

Variational and Extremum Principles in Macroscopic Systems Stanislaw Sieniutycz, Henrik Farkas, 2010-07-07 Recent years have seen a growing trend to derive models of macroscopic phenomena encountered in the fields of engineering physics chemistry ecology self organisation theory and econophysics from various variational or extremum principles Through the link between the integral extremum of a functional and the local extremum of a function explicit for example in the Pontryagin's maximum principle variational and extremum principles are mutually related Thus it makes sense to consider them within a common context The main goal of Variational and Extremum Principles in Macroscopic Systems is to collect various mathematical formulations and examples of physical reasoning that involve both basic theoretical aspects and applications of variational and extremum approaches to systems of the macroscopic world The

first part of the book is focused on the theory whereas the second focuses on applications The unifying variational approach is used to derive the balance or conservation equations phenomenological equations linking fluxes and forces equations of change for processes with coupled transfer of energy and substance and optimal conditions for energy management A unique multidisciplinary synthesis of variational and extremum principles in theory and application A comprehensive review of current and past achievements in variational formulations for macroscopic processes Uses Lagrangian and Hamiltonian formalisms as a basis for the exposition of novel approaches to transfer and conversion of thermal solar and chemical energy

Mathematical Theory of Nonequilibrium Steady States Da-Quan Jiang, Donghua Jiang, 2004 *Chemical Engineering and Chemical Process Technology - Volume I* Ryszard Pohorecki, John Bridgwater, M. Molzahn. Rafiqul Gani and Crispulo Gallegos, 2010-11-30 Chemical Engineering and Chemical Process Technology is a theme component of Encyclopedia of Chemical Sciences Engineering and Technology Resources in the global Encyclopedia of Life Support Systems EOLSS which is an integrated compendium of twenty Encyclopedias Chemical engineering is a branch of engineering dealing with processes in which materials undergo changes in their physical or chemical state These changes may concern size energy content composition and or other application properties Chemical engineering deals with many processes belonging to chemical industry or related industries petrochemical metallurgical food pharmaceutical fine chemicals coatings and colors renewable raw materials biotechnological etc and finds application in manufacturing of such products as acids alkalis salts fuels fertilizers crop protection agents ceramics glass paper colors dyestuffs plastics cosmetics vitamins and many others It also plays significant role in environmental protection biotechnology nanotechnology energy production and sustainable economical development The Theme on Chemical Engineering and Chemical Process Technology deals in five volumes and covers several topics such as Fundamentals of Chemical Engineering Unit Operations Fluids Unit Operations Solids Chemical Reaction Engineering Process Development Modeling Optimization and Control Process Management The Future of Chemical Engineering Chemical Engineering Education Main Products which are then expanded into multiple subtopics each as a chapter These five volumes are aimed at the following five major target audiences University and College students Educators Professional practitioners Research personnel and Policy analysts managers and decision makers and NGOs

Fractional Differential Equations Igor Podlubny, 1998-10-27 This book is a landmark title in the continuous move from integer to non integer in mathematics from integer numbers to real numbers from factorials to the gamma function from integer order models to models of an arbitrary order For historical reasons the word fractional is used instead of the word arbitrary This book is written for readers who are new to the fields of fractional derivatives and fractional order mathematical models and feel that they need them for developing more adequate mathematical models In this book not only applied scientists but also pure mathematicians will find fresh motivation for developing new methods and approaches in their fields of research A reader will find in this book everything necessary for the initial study and immediate

application of fractional derivatives fractional differential equations including several necessary special functions basic theory of fractional differentiation uniqueness and existence theorems analytical numerical methods of solution of fractional differential equations and many inspiring examples of applications A unique survey of many applications of fractional calculus Presents basic theory Includes a unified presentation of selected classical results which are important for applications Provides many examples Contains a separate chapter of fractional order control systems which opens new perspectives in control theory The first systematic consideration of Caputo's fractional derivative in comparison with other selected approaches Includes tables of fractional derivatives which can be used for evaluation of all considered types of fractional derivatives *Applied Mechanics Reviews*, 1975 Transport Coefficients of Fluids Byung Chan Eu, 2006-09-08

In this monograph the density fluctuation theory of transport coefficients of simple and complex liquids is described together with the kinetic theory of liquids the generic van der Waals equation of state and the modified free volume theory The latter two theories are integral parts of the density fluctuation theory which enables us to calculate the density and temperature dependence of transport coefficients of liquids from intermolecular forces The terms nanoscience and bioscience are the catch phrases currently in fashion in science It seems that much of the fundamentals remaining unsolved or poorly understood in the science of condensed matter has been overshadowed by the frenzy over the more glamorous disciplines of the former shunned by novices and are on the verge of being forgotten The transport coefficients of liquids and gases and related thermophysical properties of matter appear to be one such area in the science of macroscopic properties of molecular systems and statistical mechanics of condensed matter Even nano and biomaterials however cannot be fully and appropriately understood without grounding and foundations in the macroscopic and molecular theories of transport properties and related thermophysical properties of matter in the condensed phase

One is still dealing with systems made up of not a few particles but a multitude of them often too many to count to call them few body problems that can be understood without the help of statistical mechanics and macroscopic physics In the density fluctuation theory of transport coefficients the basic approach taken is quite different from the approaches taken in the conventional kinetic theories of gases and liquids *Mathematical Reviews*, 2008 Statistical Thermodynamics And Stochastic Theory Of Nonequilibrium Systems Werner Ebeling, Igor Sokolov, 2005-09-23 This book presents both the fundamentals and the major research topics in statistical physics of systems out of equilibrium It summarizes different approaches to describe such systems on the thermodynamic and stochastic levels and discusses a variety of areas including reactions anomalous kinetics and the behavior of self propelling particles Whitaker's Books in Print, 1998 **The Concept of Equilibrium in Different Economic Traditions** Bert Tieben, 2009 **Searching for Developmental Alternatives in Economic Theory** Evgeny Kuzmin, Geoffrey M. Hodgson, Laura Bravi, Yuliya Lavrikova, 2025-05-21 This book discusses the conceptual foundations of mainstream and political economy and offers alternative directions for the development of theoretical

economics Presenting selected papers from the Euro Asian Symposium on Economic Theory held by the Institute of Economics of the Ural Branch of the Russian Academy of Sciences Ekaterinburg Russia on June 26 28 2024 this book examines the ways in which economic theory helps solve problem such as the expansion of new technologies inequality environmental justice globalization regionalization and a polycentric world It delves into the evolution and resilience of industrial ecosystems investigate the fundamental nature of money the complexities of achieving justice and efficiency in economic development are addressed examining income disparities the convergence of economies and social aspects within economic mechanisms The contributions featured in this book offer a synthesis of theoretical models and empirical analyses bridging the gap between academic inquiry and practical application This collection is a valuable resource for researchers policymakers and practitioners seeking innovative solutions to navigate the complexities of today s economic systems

Book Review Index ,2003 Vols 8 10 of the 1965 1984 master cumulation constitute a title index Rational Extended Thermodynamics beyond the Monatomic Gas Tommaso Ruggeri,Masaru Sugiyama,2015-10-15 This book is dedicated to the recent developments in RET with the aim to explore polyatomic gas dense gas and mixture of gases in non equilibrium In particular we present the theory of dense gases with 14 fields which reduces to the Navier Stokes Fourier classical theory in the parabolic limit Molecular RET with an arbitrary number of field variables for polyatomic gases is also discussed and the theory is proved to be perfectly compatible with the kinetic theory in which the distribution function depends on an extra variable that takes into account a molecule s internal degrees of freedom Recent results on mixtures of gases with multi temperature are presented together with a natural definition of the average temperature The qualitative analysis and in particular the existence of the global smooth solution and the convergence to equilibrium are also studied by taking into account the fact that the differential systems are symmetric hyperbolic Applications to shock and sound waves are analyzed together with light scattering and heat conduction and the results are compared with experimental data Rational extended thermodynamics RET is a thermodynamic theory that is applicable to non equilibrium phenomena It is described by differential hyperbolic systems of balance laws with local constitutive equations As RET has been strictly related to the kinetic theory through the closure method of moment hierarchy associated to the Boltzmann equation the applicability range of the theory has been restricted within rarefied monatomic gases The book represents a valuable resource for applied mathematicians physicists and engineers offering powerful models for potential applications like satellites reentering the atmosphere semiconductors and nano scale phenomena **The British National Bibliography** Arthur James Wells,1996

Applied Wave Mathematics II Arkadi Berezovski,Tarmo Soomere,2019-11-16 This book gathers contributions on various aspects of the theory and applications of linear and nonlinear waves and associated phenomena as well as approaches developed in a global partnership of researchers with the national Centre of Excellence in Nonlinear Studies CENS at the Department of Cybernetics of Tallinn University of Technology in Estonia The papers chiefly focus on the role of

mathematics in the analysis of wave phenomena They highlight the complexity of related topics concerning wave generation propagation transformation and impact in solids gases fluids and human tissues while also sharing insights into selected mathematical methods for the analytical and numerical treatment of complex phenomena In addition the contributions derive advanced mathematical models share innovative ideas on computing and present novel applications for a number of research fields where both linear and nonlinear wave problems play an important role The papers are written in a tutorial style intended for non specialist researchers and students The authors first describe the basics of a problem that is currently of interest in the scientific community discuss the state of the art in related research and then share their own experiences in tackling the problem Each chapter highlights the importance of applied mathematics for central issues in the study of waves and associated complex phenomena in different media The topics range from basic principles of wave mechanics up to the mathematics of Planet Earth in the broadest sense including contemporary challenges in the mathematics of society In turn the areas of application range from classic ocean wave mathematics to material science and to human nerves and tissues All contributions describe the approaches in a straightforward manner making them ideal material for educational purposes e g for courses master class lectures or seminar presentations

Classical and Relativistic Rational Extended

Thermodynamics of Gases Tommaso Ruggeri, Masaru Sugiyama, 2021-04-22 Rational extended thermodynamics RET is the theory that is applicable to nonequilibrium phenomena out of local equilibrium It is expressed by the hyperbolic system of field equations with local constitutive equations and is strictly related to the kinetic theory with the closure method of the hierarchies of moment equations The book intends to present in a systematic way new results obtained by RET of gases in both classical and relativistic cases and it is a natural continuation of the book Rational Extended Thermodynamics beyond the Monatomic Gas by the same authors published in 2015 However this book addresses much wider topics than those of the previous book Its contents are as follows RET of rarefied monatomic gases and of polyatomic gases a simplified RET theory with 6 fields being valid far from equilibrium RET where both molecular rotational and vibrational modes exist mixture of gases with multi temperature The theory is applied to several typical topics sound waves shock waves etc and is compared with experimental data From a mathematical point of view RET can be regarded as a theory of hyperbolic symmetric systems of which it is possible to conduct a qualitative analysis The book represents a valuable resource for applied mathematicians physicists and engineers offering powerful models for many potential applications such as reentering satellites into the atmosphere semiconductors and nanoscale phenomena

[The Cumulative Book Index](#) ,1998 A world list of books in the

English language **Thermal Quantum Field Theory and Perturbative Non-Equilibrium Dynamics** Peter Millington, 2013-10-29 The author develops a new perturbative formalism of non equilibrium thermal quantum field theory for non homogeneous backgrounds As a result of this formulation the author is able to show how so called pinch singularities can be removed without resorting to ad hoc prescriptions or effective resummations of absorptive effects Thus the author arrives

at a diagrammatic approach to non equilibrium field theory built from modified Feynman rules that are manifestly time dependent from tree level This new formulation provides an alternative framework in which to derive master time evolution equations for physically meaningful particle number densities which are valid to all orders in perturbation theory and to all orders in gradient expansion Once truncated in a loop wise sense these evolution equations capture non equilibrium dynamics on all time scales systematically describing energy violating processes and the non Markovian evolution of memory effects

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