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First Published in 2011. Routledge is an imprint of Taylor & Francis, an informa company. The role of small hydropower is becoming increasingly important on a global level. Increasing energy demand and environmental awareness has further triggered research and development into sustainable low-cost technologies. In developing countries, particularly in rural areas, the possibility of local power generation could considerably improve living conditions. With this in mind, the development of a next generation low-head hydropower machines was subject of investigation in the EU-project HYLOW. Being part of the research lines of that project, this thesis presents a

numerical modelling approach to improve the design of machines like water wheels for increased hydraulic efficiency. Nowadays, Computational Fluid Dynamics (CFD) enables numerical models to be quite accurate and incorporate physical complexities like free surfaces and rotating machines. The results of the CFD simulations carried out in this research show that a change in blade geometry can result in higher torque levels, thereby increasing performance. Numerical simulations also enabled to determine the optimal wheel-width to channel-width ratio and further improve performance by modifying the channel bed conditions upstream and downstream of the water wheel. With a power rating in the low kilowatt range, low-head hydropower machines like optimised water wheels seem to have a clear potential for small-scale energy generation, thereby contributing to achieving the Sustainable Development Goals by providing local energy solutions. How will we meet rising energy demands? What are our options? Are there viable long-term solutions for the future? Learn the fundamental physical, chemical and materials science at the heart of:

• Renewable/non-renewable energy sources • Future transportation systems • Energy efficiency • Energy storage Whether you are a student taking an energy course or a newcomer to the field, this textbook will help you understand critical relationships between the environment, energy and sustainability. Leading experts provide comprehensive coverage of each topic, bringing together diverse subject matter by integrating theory with engaging insights. Each chapter includes helpful features to aid understanding, including a historical overview to provide context, suggested further reading and questions for discussion. Every subject is beautifully illustrated and brought to life with full color images and color-coded sections for easy browsing, making this a complete educational package. **Fundamentals of Materials for Energy and Environmental Sustainability will enable today's scientists and educate future generations. Taking a heuristic approach to relativistic quantum mechanics, Practical Quantum Electrodynamics provides a complete introduction to the theory, methodologies, and calculations used for explaining the physical interaction of charged particles. This book combines the principles of relativity and quantum theory necessary for performing the calculations of the electromagnetic scattering of electrons and positrons and the emission and absorption of photons. Beginning with an introduction of the wave equations for spin-0 and spin-1/2 particles,**

the author compares and contrasts the relativistic and spin effects for both types of particles. He emphasizes how the relativistic treatment of quantum mechanics and the spin-1/2 degree of freedom are necessary to describe electromagnetic interactions involving electron scattering and points out the shortfalls of the wave-equation approach to relativistic quantum mechanics. Developing the Feynman rules for quantum electrodynamics by example, the book offers an intuitive, hands-on approach for performing fundamental calculations. It also illustrates how to perform calculations that can be related to experiments such as diagrams, lifetimes, and cross sections. Practical Quantum Electrodynamics builds a strong foundation for further studies and research in theoretical and particle physics, particularly relativistic quantum field theory or nonrelativistic many-body theory. Filling the need for a book bridging the effect of matter on X-ray radiation and the interaction of x-rays with plasmas, this monograph provides comprehensive coverage of the topic. As such, it presents and explains such powerful new X-ray sources as X-ray free-electron lasers, as well as short pulse interactions with solids, clusters, molecules, and plasmas, and X-ray matter interactions as a diagnostic tool. Equally useful for researchers and practitioners working in the field. Complex system theory is rapidly developing and gaining importance, providing tools and concepts central to our modern understanding of emergent phenomena. This primer offers an introduction to this area together with detailed coverage of the mathematics involved. All calculations are presented step by step and are straightforward to follow. This new third edition comes with new material, figures and exercises. Network theory, dynamical systems and information theory, the core of modern complex system sciences, are developed in the first three chapters, covering basic concepts and phenomena like small-world networks, bifurcation theory and information entropy. Further chapters use a modular approach to address the most important concepts in complex system sciences, with the emergence and self-organization playing a central role. Prominent examples are self-organized criticality in adaptive systems, life at the edge of chaos, hypercycles and coevolutionary avalanches, synchronization phenomena, absorbing phase transitions and the cognitive system approach to the brain. Technical course prerequisites are the standard mathematical tools for an advanced undergraduate course in the natural sciences or engineering. Each chapter comes with exercises and suggestions for

further reading - solutions to the exercises are provided in the last chapter. From the reviews of previous editions: This is a very interesting introductory book written for a broad audience of graduate students in natural sciences and engineering. It can be equally well used both for teaching and self-education. Very well structured and every topic is illustrated by simple and motivating examples. This is a true guidebook to the world of complex nonlinear phenomena. (Ilya Pavlyukevich, Zentralblatt MATH, Vol. 1146, 2008) "Claudius Gros's Complex and Adaptive Dynamical Systems: A Primer is a welcome addition to the literature. . A particular strength of the book is its emphasis on analytical techniques for studying complex systems. (David P. Feldman, Physics Today, July, 2009) Get the latest on rapidly evolving global electricity markets direct from the scholars and thought leaders who are shaping reform. In this volume, dozens of world-class experts from diverse regions provide a comprehensive assessment of the relevant issues in today's electricity markets. Amid a seething backdrop of rising energy prices, concerns about environmental degradation, and the introduction of distributed sources and smart grids, increasingly stringent demands are being placed on the electric power sector to provide a more reliable, efficient delivery infrastructure, and more rational, cost-reflective prices. This book maps out the electric industry's new paradigms, challenges and approaches, providing invaluable global perspective on this host of new and pressing issues being investigated by research institutions worldwide. Companies engaged in the power sector's extensive value chain including utilities, generation, transmission & distribution companies, retailers, suppliers, regulators, market designers, and the investment & financial rating community will benefit from gaining a more nuanced understanding of the impacts of key market design and restructuring choices. How can problems be avoided? Why do some restructured markets appear to function better than others? Which technological implementations represent the best investments? Which regulatory mechanisms will best support these new technologies? What lessons can be learned from experiences in Norway, Australia, Texas, or the U.K.? These questions and many more are undertaken by the brightest minds in the industry in this one comprehensive, cutting-edge resource. Features a unique global perspective from more than 40 recognized experts and scholars around the world, offering opportunities to compare and contrast a wide range of market

structures Analyzes how the implementation of existing and developing market designs impacts real-world issues such as pricing and reliability Explains the latest thinking on timely issues such as current market reform proposals, restructuring, liberalization, privatization, capacity and energy markets, distributed and renewable energy integration, competitive generation and retail markets, and disaggregated vs. vertically integrated systems This book of Proceedings presents the latest thinking and research in the rapidly evolving world of architecture and sustainable development through 255 selected papers by authors coming from over 60 countries. The accomplishment of visionary individuals and citizen groups across the US. This is a sequel to the review volume Quark-Gluon Plasma. There are 13 articles contributed by leading investigators in the field, covering a wide range of topics about the theoretical approach to the subject. These contributions are timely reviews of nearly all the actively pursued problems, written in a pedagogical style suitable for beginners as well as experienced researchers. Noncarboxylic Acids—Advances in Research and Application: 2013 Edition is a ScholarlyEditions™ book that delivers timely, authoritative, and comprehensive information about Hydrogen Sulfide. The editors have built Noncarboxylic Acids—Advances in Research and Application: 2013 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Hydrogen Sulfide in this book to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Noncarboxylic Acids—Advances in Research and Application: 2013 Edition has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at <http://www.ScholarlyEditions.com/>. This book examines the characteristics and opportunities for farm energy in the northeast quadrant of the United States, with attention to energy use, strategic energy management, and energy production by solar, wind, biomass, and other means. Throughout, the distinct characteristics of the region and their impact on energy solutions are discussed, and the outlook for future energy strategies is considered. Farm energy

production and use are topics of increasing interest, as the need for improved efficiency and the opportunity for sustainable energy production both drive agricultural enterprises to reduce energy use and pursue opportunities for renewable energy production and use on the farm. However, the unique regional characteristics of agriculture make it challenging to apply a single approach to all situations. The anthology entitled, "The Future of Energy: Challenges, Perspectives, and Solutions" includes a wide range of topics related to the probable and also possible future developments of energy technologies. The collection of papers offers a series of unprecedented perspectives on energy science, unavailable elsewhere. The authors have considered developments in renewable energy, novel energy discoveries, environmental climate futures, possible technological advances, temporal distortion, and gravitational electromagnetism. Specific energy inventors reporting breakthrough results have also been showcased in individual chapters, including Searl, Manelas, Kozyrev, and Storms. The future of energy is presented with possible scenarios such as with microgrids, solar systems, fusion-fission reactors, smart cities, energy storage, electric vehicles, low energy nuclear reactors, electromagnetic devices, proton and electron conversion, theoretical antigravity, and time manipulation. Several interesting models have been considered to provoke and stretch the reader's imagination and awareness of the study of the future. This collection of works provides a broad range of conceptual understanding of energy conversion that is both conventional and unconventional. Each chapter includes a significant use of graphs and charts, as well as explanatory equations where necessary, with plenty of vital references and links to substantiate any new scientific concepts and assist further research. More than one new phenomena of electrical power production have been discovered and the results documented in detail within the pages of this anthology. While the time schedule and specific cause of global warming is detailed, the plan for advanced energy applications is also explored. The collection of works provides a unique perspective on the evolving landscape of future energy which is provocative and enlightening. The reader will find it enriches and enlivens the discussion of what is to come. The Early Universe has become the standard reference on forefront topics in cosmology, particularly to the early history of the Universe. Subjects covered include primordial nucleosynthesis, baryogenesis, phases transitions, inflation, dark

matter, and galaxy formation, relics such as axions, neutrinos and monopoles, and speculations about the Universe at the Planck time. The book includes more than ninety figures as well as a five-page update discussing recent developments such as the COBE results. For answers to questions relating to computers, the Internet and other digital technologies - and how to make them work for your clients - turn to this comprehensive, practical resource. Whether you're an experienced IT lawyer, a transactional or intellectual property attorney, an industry executive, or a general practitioner whose clients are coming to you with new issues, you'll find practical, expert guidance on identifying and protecting intellectual property rights, drafting effective contracts, understanding applicable regulations, and avoiding civil and criminal liability. Written by Michael D. Scott, who practiced technology and business law for 29 years in Los Angeles and Silicon Valley, Scott on Information Technology Law, Third Edition offers a real-world perspective on how to structure transactions involving computer products and services such as software development, marketing, and licensing. He also covers the many substantive areas that affect technology law practice, including torts, constitutional issues, and the full range of intellectual property protections. You'll find coverage of the latest issues like these: computer and cybercrime, including spyware, phishing, denial of service attacks, and more traditional computer crimes the latest judicial thinking on software and business method patents open source licensing outsourcing of IT services and the legal and practical issues involved in making it work and more To help you quickly identify issues, the book also includes practice pointers and clause-by-clause analysis of the most common and often troublesome provisions of IT contracts. Enthusiasm for research on the quantum Hall effect (QHE) is unbounded. The QHE is one of the most fascinating and beautiful phenomena in all branches of physics. Tremendous theoretical and experimental developments are still being made in this sphere. Composite bosons, composite fermions and anyons were among distinguishing ideas in the original edition. In the 2nd edition, fantastic phenomena associated with the interlayer phase coherence in the bilayer system were extensively described. The microscopic theory of the QHE was formulated based on the noncommutative geometry. Furthermore, the unconventional QHE in graphene was reviewed, where the electron dynamics can be treated as relativistic Dirac

fermions and even the supersymmetric quantum mechanics plays a key role. In this 3rd edition, all chapters are carefully reexamined and updated. A highlight is the new chapter on topological insulators. Indeed, the concept of topological insulator stems from the QHE. Other new topics are recent prominent experimental discoveries in the QHE, provided by the experimentalists themselves in Part V. This new edition presents an instructive and comprehensive overview of the QHE. It is also suitable for an introduction to quantum field theory with vividly described applications. Only knowledge of quantum mechanics is assumed. This book is ideal for students and researchers in condensed matter physics, particle physics, theoretical physics and mathematical physics. This book deals with the coupling of two or more angular momenta, angular momentum coupling coefficients, rotation matrices, tensor operators, evaluation of matrix elements, the gradient formula, identical particles, statistical tensors and polarization phenomena, traces of angular momentum matrices, the helicity formalism and the spin states of the Dirac particle. These topics cover the entire range of angular momentum techniques that are being widely used in the study of both non-relativistic and relativistic problems in physics. At the end of each chapter, review questions, problems and solutions to selected problems are given in order to enable the reader to have a clearer understanding of the subject. Audience: This volume will serve as a valuable reference monograph for research workers in particle physics, nuclear physics and material science. It is also recommended as a text in angular momentum techniques for graduate students of physics and chemistry. Thin-film solar cells are either emerging or about to emerge from the research laboratory to become commercially available devices finding practical various applications. Currently no textbook outlining the basic theoretical background, methods of fabrication and applications currently exist. Thus, this book aims to present for the first time an in-depth overview of this topic covering a broad range of thin-film solar cell technologies including both organic and inorganic materials, presented in a systematic fashion, by the scientific leaders in the respective domains. It covers a broad range of related topics, from physical principles to design, fabrication, characterization, and applications of novel photovoltaic devices. This book is devoted to the broad subject of flavor physics, embracing the question of what distinguishes one type of elementary particles from another. The

articles range from the forefront of formal theory (treating the physics of extra dimensions) to details of particle detectors. Although special emphasis is placed on the physics of kaons, charmed and beauty particles, top quarks, and neutrinos, the articles also dealing with electroweak physics, quantum chromodynamics, supersymmetry, and dynamical electroweak symmetry breaking. Violations of fundamental symmetries such as time reversal invariance are discussed in the context of neutral kaons, beauty particles, electric dipole moments, and parity violation in atoms. The physics of the Cabibbo-Kobayashi-Maskawa matrix and of quark masses are described in some detail, both from the standpoint of present and future experimental knowledge and from a more fundamental viewpoint, where physicists are still searching for the correct theory. Contents: The Electroweak Theory (C Quigg); CP Violation (L Wolfenstein); Precision Electroweak Physics (Y-K Kim); Kaon and Charm Physics: Theory (G Buchalla); Kaon Physics: Experiments (T Barker); The Status of Mixing in the Charm Sector (J P Cumalat); Basics of QCD Perturbation Theory (D E Soper); Lattice QCD and the CKM Matrix (T DeGrand); The Strong CP Problem (M Dine); A Bibliography of Atomic Parity Violation and Electric Dipole Moment Experiments (C E Wieman); The CKM Matrix and the Heavy Quark Expansion (A F Falk); CP Violation in B Decays (J L Rosner); Lectures on the Theory of Nonleptonic B Decays (M Neubert); Asymmetrical e Collisions (A Roodman); Pathological Science (S Stone); Top Physics (E H Simmons); Neutrino Mass, Mixing, and Oscillation (B Kayser); Flavor in Supersymmetry (H Murayama); Technicolor and Compositeness (R S Chivukula); Models of Fermion Masses (G G Ross); Physics of Extra Dimensions (J D Lykken). Readership: Graduate students, postdoctoral fellows and senior researchers in high energy physics." Meet Michael Skelly, the man boldly harnessing wind energy that could power America's future and break its fossil fuel dependence in this "essential, compelling look into the future of the nation's power grid" (Bryan Burrough, author of The Big Rich). The United States is in the midst of an energy transition. We have fallen out of love with dirty fossil fuels and want to embrace renewable energy sources like wind and solar. A transition from a North American power grid that is powered mostly by fossil fuels to one that is predominantly clean is feasible, but it would require a massive building spree—wind turbines, solar panels, wires, and billions of dollars would be needed. Enter

Michael Skelly, an infrastructure builder who began working on wind energy in 2000 when many considered the industry a joke. Eight years later, Skelly helped build the second largest wind power company in the United States—and sold it for \$2 billion. Wind energy was no longer funny—it was well on its way to powering more than 6% of electricity in the United States. Award-winning journalist, Russel Gold tells Skelly's story, which in many ways is the story of our nation's evolving relationship with renewable energy. Gold illustrates how Skelly's company, Clean Line Energy, conceived the idea for a new power grid that would allow sunlight where abundant to light up homes in the cloudy states thousands of miles away, and take wind from the Great Plains to keep air conditioners running in Atlanta. Thrilling, provocative, and important, Superpower is a fascinating look at America's future. Discusses whether municipal electric utility customers are eligible for the Home Energy Solutions audit program under the provisions of PA 12-2 of the June 12 Special Session. A tutorial for calculating the response of molecules to electric and magnetic fields with examples from research in ultracold physics, controlled chemistry, and molecular collisions in fields Molecules in Electromagnetic Fields is intended to serve as a tutorial for students beginning research, theoretical or experimental, in an area related to molecular physics. The author—a noted expert in the field—offers a systematic discussion of the effects of static and dynamic electric and magnetic fields on the rotational, fine, and hyperfine structure of molecules. The book illustrates how the concepts developed in ultracold physics research have led to what may be the beginning of controlled chemistry in the fully quantum regime. Offering a glimpse of the current state of the art research, this book suggests future research avenues for ultracold chemistry. The text describes theories needed to understand recent exciting developments in the research on trapping molecules, guiding molecular beams, laser control of molecular rotations, and external field control of microscopic intermolecular interactions. In addition, the author presents the description of scattering theory for molecules in electromagnetic fields and offers practical advice for students working on various aspects of molecular interactions. This important text: Offers information on the effects of electromagnetic fields on the structure of molecular energy levels Includes thorough descriptions of the most useful theories for ultracold molecule researchers Presents a wealth of

illustrative examples from recent experimental and theoretical work Contains helpful exercises that help to reinforce concepts presented throughout text Written for senior undergraduate and graduate students, professors, researchers, physicists, physical chemists, and chemical physicists, Molecules in Electromagnetic Fields is an interdisciplinary text describing theories and examples from the core of contemporary molecular physics. Special edition of the Federal Register, containing a codification of documents of general applicability and future effect ... with ancillaries. RELATIVISTIC QUANTUM PHYSICS includes in its fold both Relativistic Quantum Mechanics and Quantum Field Theory. It is shown how Feynman's positron theory and Feynman diagrams have greatly simplified the calculations for various processes in Quantum Electrodynamics. Elements of Quantum Field Theory and its essential features are also presented. Neutrinos and neutrino oscillations, Gauge theories and Gauge bosons, Higgs field and Higgs bosons, spontaneous symmetry breaking and Higgs mechanism, and how the particles acquire mass by Higgs mechanism are some of the topics that are dealt with exhaustively in this book. Energy Lab for Kids offers 40 discovery-filled and thought-provoking energy projects by Emily Hawbaker, a science educator from the NEED (National Energy Education Development) project—with a foreword by Liz Lee Heinecke, author of Kitchen Science Lab for Kids. Using supplies that you can find around the house or in the grocery store, these exciting projects let you observe, explore, discover, and get energized! We hear about energy on the news, we use it every day, and sometimes we're told we have too much of it. But what is energy—potential, kinetic, chemical, radiant, and thermal? The lab activities in this book will let you explore almost everything about energy—what it is, how we find it, how we use it, and how we can save it. Uniting this collection of science experiments for the kitchen, backyard, or classroom is the goal to explore and discover real energy solutions. The chapters cross all categories—from steam, electricity, and chemical reactions, to water, solar, and wind power—allowing kids to compare and test the different sources and to discover their strengths and failings. Why is one source of energy is more efficient for a one situation but not for another? Why might two energy sources combined work better than a single source? Which sources are renewable? Projects are geared to understanding actual issues in the news today. With an emphasis on inventive exploration,

you'll discover that creativity leads to breakthroughs. Learn about: chemical, radiant, and thermal energy by activating a glow stick and watching it get brighter in hot water. viscosity by sucking soda and chocolate syrup up an "oil pipeline" made from straws. solar energy by melting s'mores in a pizza box solar oven. wind power by lifting paperclips with a wind turbine made from a cup, paper, tape, and straw. calories by burning cheese puffs (and other food) in a homemade calorimeter. The popular Lab for Kids series features a growing list of books that share hands-on activities and projects on a wide host of topics, including art, astronomy, clay, geology, math, and even how to create your own circus—all authored by established experts in their fields. Each lab contains a complete materials list, clear step-by-step photographs of the process, as well as finished samples. The labs can be used as singular projects or as part of a yearlong curriculum of experiential learning. The activities are open-ended, designed to be explored over and over, often with different results. Geared toward being taught or guided by adults, they are enriching for a range of ages and skill levels. Gain firsthand knowledge on your favorite topic with Lab for Kids. • New York Times bestseller • The 100 most substantive solutions to reverse global warming, based on meticulous research by leading scientists and policymakers around the world "At this point in time, the Drawdown book is exactly what is needed; a credible, conservative solution-by-solution narrative that we can do it. Reading it is an effective inoculation against the widespread perception of doom that humanity cannot and will not solve the climate crisis. Reported by-effects include increased determination and a sense of grounded hope." —Per Espen Stoknes, Author, What We Think About When We Try Not To Think About Global Warming "There's been no real way for ordinary people to get an understanding of what they can do and what impact it can have. There remains no single, comprehensive, reliable compendium of carbon-reduction solutions across sectors. At least until now. . . . The public is hungry for this kind of practical wisdom." —David Roberts, Vox "This is the ideal environmental sciences textbook—only it is too interesting and inspiring to be called a textbook." —Peter Kareiva, Director of the Institute of the Environment and Sustainability, UCLA In the face of widespread fear and apathy, an international coalition of researchers, professionals, and scientists have come together to offer a set of realistic and bold

solutions to climate change. One hundred techniques and practices are described here—some are well known; some you may have never heard of. They range from clean energy to educating girls in lower-income countries to land use practices that pull carbon out of the air. The solutions exist, are economically viable, and communities throughout the world are currently enacting them with skill and determination. If deployed collectively on a global scale over the next thirty years, they represent a credible path forward, not just to slow the earth's warming but to reach drawdown, that point in time when greenhouse gases in the atmosphere peak and begin to decline. These measures promise cascading benefits to human health, security, prosperity, and well-being—giving us every reason to see this planetary crisis as an opportunity to create a just and livable world.

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