

Electric Forces On Charges Mit Opencourseware

The process of user-centered innovation: how it can benefit both users and manufacturers and how its emergence will bring changes in business models and in public policy. Innovation is rapidly becoming democratized. Users, aided by improvements in computer and communications technology, increasingly can develop their own new products and services. These innovating users—both individuals and firms—often freely share their innovations with others, creating user-innovation communities and a rich intellectual commons. In *Democratizing Innovation*, Eric von Hippel looks closely at this emerging system of user-centered innovation. He explains why and when users find it profitable to develop new products and services for themselves, and why it often pays users to reveal their innovations freely for the use of all. The trend toward democratized innovation can be seen in software and information products—most notably in the free and open-source software movement—but also in physical products. Von Hippel's many examples of user innovation in action range from surgical equipment to surfboards to software security features. He shows that product and service development is concentrated among "lead users," who are ahead on marketplace trends and whose innovations are often commercially attractive. Von Hippel argues that manufacturers should redesign their innovation processes and that they should systematically seek out innovations developed by users. He points to businesses—the custom semiconductor industry is one example—that have learned to assist user-innovators by providing them with toolkits for developing new products. User innovation has a positive impact on social welfare, and von Hippel proposes that

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government policies, including R&D subsidies and tax credits, should be realigned to eliminate biases against it. The goal of a democratized user-centered innovation system, says von Hippel, is well worth striving for. An electronic version of this book is available under a Creative Commons license.

An authoritative and unbiased guide to nuclear technology and the controversies that surround it. Are you for nuclear power or against it? What's the basis of your opinion? Did you know a CT scan gives you some 2 millisieverts of radiation? Do you know how much a millisievert is? Does irradiation make foods safer or less safe? What is the point of a bilateral Russia-US nuclear weapons treaty in a multipolar world? These are nuclear questions that call for nuclear choices, and this book equips citizens to make these choices informed ones. It explains, clearly and accessibly, the basics of nuclear technology and describes the controversies surrounding its use.

In order to equip hopeful graduate students with the knowledge necessary to pass the qualifying examination, the authors have assembled and solved standard and original problems from major American universities – Boston University, University of Chicago, University of Colorado at Boulder, Columbia, University of Maryland, University of Michigan, Michigan State, Michigan Tech, MIT, Princeton, Rutgers, Stanford, Stony Brook, University of Wisconsin at Madison – and Moscow Institute of Physics and Technology. A wide range of material is covered and comparisons are made between similar problems of different schools to provide the student with enough information to feel comfortable and confident at the exam. Guide to Physics Problems is published in two volumes: this book, Part 1, covers Mechanics, Relativity and Electrodynamics; Part 2 covers Thermodynamics, Statistical Mechanics and Quantum Mechanics. Praise for A Guide to Physics Problems: Part 1:

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Mechanics, Relativity, and Electrodynamics: "Sidney Cahn and Boris Nadgorny have energetically collected and presented solutions to about 140 problems from the exams at many universities in the United States and one university in Russia, the Moscow Institute of Physics and Technology. Some of the problems are quite easy, others are quite tough; some are routine, others ingenious." (From the Foreword by C. N. Yang, Nobelist in Physics, 1957) "Generations of graduate students will be grateful for its existence as they prepare for this major hurdle in their careers." (R. Shankar, Yale University) "The publication of the volume should be of great help to future candidates who must pass this type of exam." (J. Robert Schrieffer, Nobelist in Physics, 1972) "I was positively impressed ... The book will be useful to students who are studying for their examinations and to faculty who are searching for appropriate problems." (M. L. Cohen, University of California at Berkeley) "If a student understands how to solve these problems, they have gone a long way toward mastering the subject matter." (Martin Olsson, University of Wisconsin at Madison) "This book will become a necessary study guide for graduate students while they prepare for their Ph.D. examination. It will become equally useful for the faculty who write the questions." (G. D. Mahan, University of Tennessee at Knoxville)

background needed to make informed choices about nuclear technologies, introducing concepts that can be used for evaluating the claims of both proponents and opponents. In this volume Pierre Duhem first gives an overview of 19th century electricity and magnetism. Next, he applies his keen historical, philosophical, and physical intuition to critiquing Maxwell's theories, especially his electromagnetic theory of light and the ad hoc introduction of displacement current, which he considers too much a product of the "esprit de géométrie" than the "esprit de finesse," as Pascal calls it. In

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this book, Duhem is guided by the principle that a theory that offers contradictions, even if the theory is posed by a genius, needs to be analysed and discussed until a clear distinction can be made between the propositions likely to be logically demonstrated and statements that offend logic and which must be transformed or rejected. Furthermore, Duhem felt, in criticizing such a theory one must guard against narrowness of mind and petty corrections which would make one forget the merit of the inventor; and, more importantly, one must guard against the blind superstition which, for admiration of the author, would hide the serious defects of the work. He is not so great a genius that he surpasses the laws of reason. Pierre Duhem (1861-1916), chairman of theoretical physics at Bordeaux in 1884-1916, is well-known for his works in the history and philosophy of science.

Tools to make hard problems easier to solve. In this book, Sanjoy Mahajan shows us that the way to master complexity is through insight rather than precision. Precision can overwhelm us with information, whereas insight connects seemingly disparate pieces of information into a simple picture. Unlike computers, humans depend on insight. Based on the author's fifteen years of teaching at MIT, Cambridge University, and Olin College, *The Art of Insight in Science and Engineering* shows us how to build insight and find understanding, giving readers tools to help them solve any problem in science and engineering. To master complexity, we can organize it or discard it. *The Art of Insight in Science and Engineering* first teaches the tools for organizing complexity, then distinguishes the two paths for discarding complexity: with and without loss of information. Questions and problems throughout the text help readers master and apply these groups of tools. Armed with this three-part toolchest, and without complicated mathematics, readers can estimate the flight range of birds and planes and the strength

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of chemical bonds, understand the physics of pianos and xylophones, and explain why skies are blue and sunsets are red. The Art of Insight in Science and Engineering will appear in print and online under a Creative Commons Noncommercial Share Alike license.

25 Die Ventile leiten nur während einer sehr kurzen Zeit, nämlich dann, wenn das Potential der Anode positiv gegenüber der Kathode ist. Fig. 24 zeigt eine dreistufige Anordnung. Unter der Annahme idealer Ventile und unter Vernachlässigung der Streukapazitäten stellen sich an den Knotenpunkten 3, 2, 1 und 3^* , 2^* , 1^* die in Fig. 25 wiedergegebenen Spannungen ein. Der hier dargestellte, idealisierte Generator liefert eine Leerlaufspannung von $6U_0$, wobei mit U_0 die Amplitude der Transformatorspannung bezeichnet ist. f) Der Kaskadengenerator bei Belastung. Wird der Kaskadengenerator durch einen Widerstand oder durch ein Beschleunigungsrohr belastet, so sinkt naturgemäß die Leerlaufspannung. Fig. 25. Leerlaufspannungen beim Generator in Fig. 24. Fig. 26. Der belastete Kaskadengenerator. Gemäß die Ausgangsspannung, und zwar umso stärker, je größer der Belastungsstrom I_g ist. Unter I_g wollen wir den vom Generator gelieferten, arithmetischen Mittelwert des Stromes, also den abgegebenen Gleichstrom verstehen. Während einer Periode der Wechselspannung wird der Glättungsaure somit die Ladung $Q = I_g (1.1) f$ entzogen. Falls ein stationärer Zustand bestehen soll, muß diese Ladung periodisch wieder zugeführt werden. Dies geschieht dadurch, daß während einer Halbwelle der Wechselspannung die Ladung Q von den Punkten 3^* nach 3, bzw. 2^* nach 2 und 1^* nach 1 fließt, während in der anderen Halbwelle die Ladung Q von Erde nach 3^* bzw. von 3 nach 2^* und von 2 nach 1^* transportiert wird.

Engineering Physics is a complete textbook written for the

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diploma students according to the syllabi followed in the Indian institutes offering diploma courses in engineering. The book aims to provide a thorough understanding of the basic concepts, theories and principles of Engineering Physics, in as easy and straightforward manner as possible, to enable the average students grasp the intricacies of the subject. Special attempts have been made to design this book, through clear concepts, proper explanations with necessary diagrams and mathematical derivations to make the book student friendly. Besides, the book covers some advanced topics such as communication systems, ultrasonics and laser technology with their wide range of applications in several fields of science, technology, industry and medicine, etc. The book not only provides a clear theoretical concept of the subject but also includes a large number of solved problems followed by unsolved problems to reinforce theoretical understanding of the concepts. Moreover, the book contains sixteen chapters and each chapter contains glossary terms, short questions, and long questions for practice. **KEY FEATURES** • Logically organised content for sequential learning • Learning outcomes at the beginning of each chapter • Important concepts and generalisations highlighted in the text • Chapter-end quick review

The book includes different contributions that cover interdisciplinary research in the areas of • Error controlled numerical methods, efficient algorithms and software development • Elastic and in elastic deformation processes • Models with multiscales and multi-physics “High Performance” adaptive numerical methods using finite elements (FEM) and boundary elements (BEM) are described as well as efficient solvers for linear systems and corresponding software components for non-linear, coupled field equations of various branches of mechanics, electromagnetics, and geosciences.

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Experiments and problems to be done by the non-specialist to aid in his understanding of crystals

This comprehensive reference collects fundamental theories and recent research from a wide range of fields including biology, biochemistry, physics, applied mathematics, and computer, materials, surface, and colloid science-providing key references, tools, and analytical techniques for practical applications in industrial, agricultural, and forensic processes, as well as in the production of natural and synthetic compounds such as foods, minerals, paints, proteins, pharmaceuticals, polymers, and soaps.

This book reviews the application of nanosensors in food and agriculture. Nanotechnology has the potential to become transformative technology that will impact almost all sectors. Tools like nanosensors, which detect specific molecular interactions, can be used for on-site, in-situ and online measurements of various parameters in clinical diagnostics, environmental and food monitoring, and quality control. Due to their unprecedented performance and sensitivity, nanobiosensors are gaining importance in precision farming. The book examines the use of nanobiosensors in the monitoring of food additives, toxins and mycotoxins, microbial contamination, food allergens, nutritional constituents, pesticides, environmental parameters, plant diseases and genetically modified organisms. It also discusses the role of biosensors in increasing crop productivity in sustainable agriculture, and nanosensor-based smart delivery systems to optimize the use of natural resources such as water,

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nutrients and agrochemicals in precision farming. Largely autobiographical account of the author's life as one who fell in love first with physics and then with teaching physics to students.

The bestselling cyberpunk author “has produced by far the most stylish report from the computer outlaw culture since Steven Levy’s Hackers” (Publishers Weekly).

Bruce Sterling delves into the world of high-tech crime and punishment in one of the first books to explore the cyberspace breaches that threaten national security.

From the crash of AT&T’s long-distance switching system to corporate cyberattacks, he investigates government and law enforcement efforts to break the back of America’s electronic underground in the 1990s.

In this modern classic, “Sterling makes the hackers—who live in the ether between terminals under noms de net such as VaxCat—as vivid as Wyatt Earp and Doc Holliday. His book goes a long way towards explaining the emerging digital world and its ethos” (Publishers Weekly). This edition features a new preface by the author that analyzes the sobering increase in computer crime over the twenty-five years since *The Hacker Crackdown* was first published. “Offbeat and brilliant.”

—Booklist “Thoroughly researched, this account of the government’s crackdown on the nebulous but growing computer-underground provides a thoughtful report on the laws and rights being defined on the virtual frontier of cyberspace. . . . An enjoyable, informative, and (as the first mainstream treatment of the subject) potentially important book . . . Sterling is a fine and knowledgeable guide to this strange new world.” —Kirkus Reviews “A

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well-balanced look at this new group of civil libertarians. Written with humor and intelligence, this book is highly recommended.” —Library Journal

Fields, Forces, and Flows in Biological Systems describes the fundamental driving forces for mass transport, electric current, and fluid flow as they apply to the biology and biophysics of molecules, cells, tissues, and organs. Basic mathematical and engineering tools are presented in the context of biology and physiology. The chapters are structure

This authoritative text offers a unified, programmed summary of the principles underlying all charged particle accelerators — it also doubles as a reference collection of equations and material essential to accelerator development and beam applications. The only text that covers linear induction accelerators, the work contains straightforward expositions of basic principles rather than detailed theories of specialized areas. 1986 edition.

Designed to be used as a graduate-level text and as an engineering reference work, "Continuum Electromechanics" presents a comprehensive development of its subject--the interaction of electromagnetic forces and ponderable media, the mechanical responses to electromagnetic fields, and the reciprocal effects of the material motions produced by those fields. The author's approach is highly interdisciplinary, and he introduces fundamental concepts from such subjects as electrohydrodynamics, magnetohydrodynamics, plasma physics, electron beam engineering, fluid mechanics, heat transfer, and physical chemistry. The applications of continuum electromechanics are also remarkably diverse, and many of them are treated in the book, both because of their intrinsic engineering importance and as a means of illustrating basic principles. Among these applications are the

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design of rotating machines and synchronous generators, polymer processing, magnetic melting and pumping in metallurgical operations, the processing of plastics and glass, the manufacture of synthetic fibers, inductive and dielectric heating, thermal-to-electrical energy conversion, the control of air pollution, the design of controlled-fusion devices, image processing and printing, the magnetic levitation and propulsion of vehicles, the study of films and membranes, and the analysis of the complex electrokinetic and physicochemical processes that underlie the sensing and motor functions of biological systems. Many of these applications are presented in the form of problems. The book consists of eleven chapters, entitled Introduction to Continuum Electromechanics; Electrodynamics; Approximations, and Relations; Electromagnetic Forces, Force Densities, and Stress Tensors; Electromechanical Kinematics; Energy-Conversion Models and Processes; Charge Migration, Convection, and Relaxation; Magnetic Diffusion and Induction Interactions; Laws, Approximations, and Relations of Fluid Mechanics Statics and Dynamics of Systems Having a Static Equilibrium; Electromechanical Flows; Electromechanics with Thermal and Molecular Diffusion; and Streaming Interactions.

The first textbook on micron-scale mobile robotics, introducing the fundamentals of design, analysis, fabrication, and control, and drawing on case studies of existing approaches. Progress in micro- and nano-scale science and technology has created a demand for new microsystems for high-impact applications in healthcare, biotechnology, manufacturing, and mobile sensor networks. The new robotics field of microrobotics has emerged to extend our interactions and explorations to sub-millimeter scales. This is the first textbook on micron-scale mobile robotics, introducing the fundamentals of design, analysis, fabrication, and control,

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and drawing on case studies of existing approaches. The book covers the scaling laws that can be used to determine the dominant forces and effects at the micron scale; models forces acting on microrobots, including surface forces, friction, and viscous drag; and describes such possible microfabrication techniques as photo-lithography, bulk micromachining, and deep reactive ion etching. It presents on-board and remote sensing methods, noting that remote sensors are currently more feasible; studies possible on-board microactuators; discusses self-propulsion methods that use self-generated local gradients and fields or biological cells in liquid environments; and describes remote microrobot actuation methods for use in limited spaces such as inside the human body. It covers possible on-board powering methods, indispensable in future medical and other applications; locomotion methods for robots on surfaces, in liquids, in air, and on fluid-air interfaces; and the challenges of microrobot localization and control, in particular multi-robot control methods for magnetic microrobots. Finally, the book addresses current and future applications, including noninvasive medical diagnosis and treatment, environmental remediation, and scientific tools.

“YOU HAVE CHANGED MY LIFE” is a common refrain in the emails Walter Lewin receives daily from fans who have been enthralled by his world-famous video lectures about the wonders of physics. “I walk with a new spring in my step and I look at life through physics-colored eyes,” wrote one such fan. When Lewin’s lectures were made available online, he became an instant YouTube celebrity, and The New York Times declared, “Walter Lewin delivers his lectures with the panache of Julia Child bringing French cooking to amateurs and the zany theatricality of YouTube’s greatest hits.” For more than thirty years as a beloved professor at the Massachusetts Institute of Technology, Lewin honed his

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singular craft of making physics not only accessible but truly fun, whether putting his head in the path of a wrecking ball, supercharging himself with three hundred thousand volts of electricity, or demonstrating why the sky is blue and why clouds are white. Now, as Carl Sagan did for astronomy and Brian Green did for cosmology, Lewin takes readers on a marvelous journey in *For the Love of Physics*, opening our eyes as never before to the amazing beauty and power with which physics can reveal the hidden workings of the world all around us. “I introduce people to their own world,” writes Lewin, “the world they live in and are familiar with but don’t approach like a physicist—yet.” Could it be true that we are shorter standing up than lying down? Why can we snorkel no deeper than about one foot below the surface? Why are the colors of a rainbow always in the same order, and would it be possible to put our hand out and touch one? Whether introducing why the air smells so fresh after a lightning storm, why we briefly lose (and gain) weight when we ride in an elevator, or what the big bang would have sounded like had anyone existed to hear it, Lewin never ceases to surprise and delight with the extraordinary ability of physics to answer even the most elusive questions. Recounting his own exciting discoveries as a pioneer in the field of X-ray astronomy—arriving at MIT right at the start of an astonishing revolution in astronomy—he also brings to life the power of physics to reach into the vastness of space and unveil exotic uncharted territories, from the marvels of a supernova explosion in the Large Magellanic Cloud to the unseeable depths of black holes. “For me,” Lewin writes, “physics is a way of seeing—the spectacular and the mundane, the immense and the minute—as a beautiful, thrillingly interwoven whole.” His wonderfully inventive and vivid ways of introducing us to the revelations of physics impart to us a new appreciation of the remarkable beauty and intricate

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harmonies of the forces that govern our lives.

Das Multi-Ionen Transport und Reaktionsmodell wird für die Simulation von elektrochemischen Prozessen eingesetzt. Das durch das Modell gegebene System partieller Differentialgleichungen (PDE) wird mit Hilfe einer gemischten Residuen-Distribution und Finiten Elemente Methode diskretisiert und mit dem Newton Verfahren linearisiert. Dabei entstehen eine Reihe linearer Gleichungssysteme. Die Dissertation beschreibt ein physikalisch orientiertes algebraisches Mehrgitterverfahren, welches zur effizienten und robusten Lösung dieser linearen Gleichungssysteme eingesetzt werden kann. Insbesondere wird auf die Reihenfolge der Variablen und deren Wirkung auf das Gitterverhalten eingegangen. Bei der Konstruktion der Grobgitterkorrektur werden Aspekte wie eine verletzte Peclet Bedingung und die Nichtlinearität des PDE Systems beachtet.

Since it was first published in 1995, Photonic Crystals has remained the definitive text for both undergraduates and researchers on photonic band-gap materials and their use in controlling the propagation of light. This newly expanded and revised edition covers the latest developments in the field, providing the most up-to-date, concise, and comprehensive book available on these novel materials and their applications. Starting from Maxwell's equations and Fourier analysis, the authors develop the theoretical tools of photonics using principles of linear algebra and symmetry, emphasizing analogies with traditional solid-state physics and quantum theory. They then investigate the unique phenomena that take place within photonic crystals at defect sites and surfaces, from one to three dimensions. This new edition includes entirely new chapters describing important hybrid structures that use band gaps or periodicity only in some directions: periodic waveguides, photonic-crystal slabs,

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and photonic-crystal fibers. The authors demonstrate how the capabilities of photonic crystals to localize light can be put to work in devices such as filters and splitters. A new appendix provides an overview of computational methods for electromagnetism. Existing chapters have been considerably updated and expanded to include many new three-dimensional photonic crystals, an extensive tutorial on device design using temporal coupled-mode theory, discussions of diffraction and refraction at crystal interfaces, and more. Richly illustrated and accessibly written, *Photonic Crystals* is an indispensable resource for students and researchers. Extensively revised and expanded Features improved graphics throughout Includes new chapters on photonic-crystal fibers and combined index-and band-gap-guiding Provides an introduction to coupled-mode theory as a powerful tool for device design Covers many new topics, including omnidirectional reflection, anomalous refraction and diffraction, computational photonics, and much more.

New York Times Bestseller: This life story of the quirky physicist is “a thorough and masterful portrait of one of the great minds of the century” (The New York Review of Books). Raised in Depression-era Rockaway Beach, physicist Richard Feynman was irreverent, eccentric, and childishly enthusiastic—a new kind of scientist in a field that was in its infancy. His quick mastery of quantum mechanics earned him a place at Los Alamos working on the Manhattan Project under J. Robert Oppenheimer, where the giddy young man held his own among the nation’s greatest minds. There, Feynman turned theory into practice, culminating in the Trinity test, on July 16, 1945, when the Atomic Age was born. He was only twenty-seven. And he was just getting started. In this sweeping biography, James Gleick captures the forceful personality of a great man, integrating Feynman’s work and life in a way that is accessible to laymen and fascinating for

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the scientists who follow in his footsteps.

Smart materials are the way of the future in a variety of fields, from biomedical engineering and chemistry to nanoscience, nanotechnology, and robotics. Featuring an interdisciplinary approach to smart materials and structures, *Artificial Muscles: Applications of Advanced Polymeric Nanocomposites* thoroughly reviews the existing knowledge of ionic polymeric conductor nanocomposites (IPCNCs), including ionic polymeric metal nanocomposites (IPMNCs) as biomimetic distributed nanosensors, nanoactuators, nanotransducers, nanorobots, artificial muscles, and electrically controllable intelligent polymeric network structures. Authored by one of the founding fathers of the field, the book introduces fabrication and manufacturing methods of several electrically and chemically active ionic polymeric sensors, actuators, and artificial muscles, as well as a new class of electrically active polymeric nanocomposites and artificial muscles. It also describes a few apparatuses for modeling and testing various artificial muscles to show the viability of chemoactive and electroactive muscles. The authors present the theories, modeling, and numerical simulations of ionic polymeric artificial muscles' electrodynamics and chemodynamics. In addition, they feature current industrial and medical applications of IPMNCs. By covering the fabrication techniques of and novel developments in advanced polymeric nanocomposites, this book provides a solid foundation in the subject while stimulating further research.

Electrostatics - Magnetostatic field and quasi-stationary electromagnetic fields - Circuit analysis - Electromagnetic waves - Relativity, particle-field interactions.

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