

Design In Nature How The Constructal Law Governs Evolution Biology Physics Technology And Social Organization Adrian Bejan

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Frankenstein's Cat Emily Anthes 2013-03-12

Winner of 2014 AAAS/Subaru SB&F Prize for Best Young Adult Science Book Longlisted for the PEN/E.O. Wilson Literary Science Writing Award One of Nature's Summer Book Picks One of Publishers Weekly's Top Ten Spring 2013 Science Books For centuries, we've toyed with our creature companions, breeding dogs that herd and hunt, housecats that look like tigers, and teacup pigs that fit snugly in our handbags. But what happens when we take animal alteration a step further, engineering a cat that glows green under ultraviolet light or cloning the beloved family Labrador? Science has given us a whole new toolbox for tinkering with life. How are we using it? In *Frankenstein's Cat*, the journalist Emily Anthes takes us from petri dish to pet store as she explores how biotechnology is shaping the future of our furry and feathered friends. As she ventures from bucolic barnyards to a "frozen zoo" where scientists are storing DNA from the planet's most exotic creatures, she discovers how we can use cloning to protect endangered species, craft prosthetics to save injured animals, and employ genetic engineering to supply farms with disease-resistant livestock. Along the way, we meet some of the animals that are ushering in this astonishing age of enhancement, including sensor-wearing seals, cyborg beetles, a bionic bulldog, and the world's first cloned cat. Through her encounters with scientists, conservationists, ethicists, and entrepreneurs, Anthes reveals that while some of our interventions may be trivial (behold: the GloFish), others could improve the lives of many species—including our own. So what does biotechnology really mean for the world's wild things? And what do our brave new beasts tell us about ourselves? With keen insight and her trademark spunk, Anthes highlights both the peril and the promise of our scientific superpowers, taking us on an adventure into a world where our grandest science fiction fantasies are fast becoming reality.

Design with Constructal Theory - Adrian Bejan 2008-09-09

Questions and answers explore various aspects of astronomy, including the solar system, stars, planets, moons, asteroids, and comets. Full-color illustrations.

Constructal Theory of Social Dynamics - Adrian Bejan 2007-10-26

Constructal Theory of Social Dynamics brings together for the first time social scientists and engineers who present predictive theory of social organization, as a conglomerate of mating flows that morph in time to flow more easily. The book offers a new way to look at social phenomena as part of natural phenomena, and examines a new domain of application of engineering such as thermodynamic optimization, thermoeconomics and "design as science".

The Top Ten: Writers Pick Their Favorite Books - J. Peder Zane 2010-06-21

What if you asked 125 top writers to pick their favorite books? Which titles would come out on top? You'll find the answer in *The Top Ten: Writers Pick Their Favorite Books*: the ultimate guide to the world's greatest books. As writers such as Norman Mailer, Annie Proulx, Stephen King, Jonathan Franzen, Claire Messud, Margaret Drabble, Michael Chabon and Peter Carey name the ten books that have meant the most to them, you'll be reminded of books you have always loved and introduced to works awaiting your discovery. The Top Ten includes summaries of 544 books—each of which is considered to be among the ten greatest books ever written by at least one leading writer. In addition to each writer's Top Ten List, the book features Top Ten Lists tabulated from their picks, including: • The Top Ten Books of All Time • The

Top Ten Books by Living Writers • The Top Ten Books of the Twentieth Century • The Top Ten Mysteries • The Top Ten Comedies The Top Ten will help readers answer the most pressing question of all: What should I read next?

Computational Modeling in Biomedical Engineering and Medical Physics - Alexandru Morega 2020-09-15

Mathematical and numerical modelling of engineering problems in medicine is aimed at unveiling and understanding multidisciplinary interactions and processes and providing insights useful to clinical care and technology advances for better medical equipment and systems. When modelling medical problems, the engineer is confronted with multidisciplinary problems of electromagnetism, heat and mass transfer, and structural mechanics with, possibly, different time and space scales, which may raise concerns in formulating consistent, solvable mathematical models. Computational Medical Engineering presents a number of engineering for medicine problems that may be encountered in medical physics, procedures, diagnosis and monitoring techniques, including electrical activity of the heart, hemodynamic activity monitoring, magnetic drug targeting, bioheat models and thermography, RF and microwave hyperthermia, ablation, EMF dosimetry, and bioimpedance methods. The authors discuss the core approach methodology to pose and solve different problems of medical engineering, including essentials of mathematical modelling (e.g., criteria for well-posed problems); physics scaling (homogenization techniques); Constructal Law criteria in morphing shape and structure of systems with internal flows; computational domain construction (CAD and, or reconstruction techniques based on medical images); numerical modelling issues, and validation techniques used to ascertain numerical simulation results. In addition, new ideas and venues to investigate and understand finer scale models and merge them into continuous media medical physics are provided as case studies. Presents the fundamentals of mathematical and numerical modeling of engineering problems in medicine Discusses many of the most common modelling scenarios for Biomedical Engineering, including, electrical activity of the heart hemodynamic activity monitoring, magnetic drug targeting, bioheat models and thermography, RF and microwave hyperthermia, ablation, EMF dosimetry, and bioimpedance methods Includes discussion of the core approach methodology to pose and solve different problems of medical engineering, including essentials of mathematical modelling, physics scaling, Constructal Law criteria in morphing shape and structure of systems with internal flows, computational domain construction, numerical modelling issues, and validation techniques used to ascertain numerical simulation results

Evolution Without Selection - A. Lima-de-Faria 1988

The interpretation of evolution is in a state of upheaval: the rapid advancement of Molecular Biology has led into question many of the tenets of Darwinism and neo-Darwinism which, although valuable approaches at the time they were formulated, never fulfilled the criteria demanded by real scientific theories. In this lucidly written new book, now available in paperback, the author presents and discusses the rapid developments in particle physics, crystallography and molecular biology, and formulates a radically different approach to biological evolution. This treatise is not offered as one more new theory but a radically different approach. In the author's opinion, no real theory of evolution can be formulated at present. Selection is not the mechanism of evolution for the simple reason that it cannot be weighed on a

balance, poured into a vial, or measured in specific units. Only a material component can be the mechanism of evolution, and this must be searched for in the strict physico-chemical processes.

Convection Heat Transfer - Vedat S. Arpacı 1984

Thermohydrodynamic Programming and Constructal Design in Microsystems - Tao Dong 2018-10-20

Thermohydrodynamic Programming and Constructal Design in Microsystems explains the direction of a morphing system configuration that is illustrated by life evolution in nature. This is sometimes referred to as the fourth law of thermodynamics, and was first applied in thermofluidic engineering, with more recent applications in physics and biology. The book specifically focuses on synthetic modeling and constructal optimization in the design of microsystemic devices, which are of particular interest to researchers and practitioners in the sphere of micro- and nanoscale physics, a mechanistically deviation from conventional theory. The book is an important reference resource for researchers working in the area of micro- and nanosystems technology and those who want to learn more about how thermodynamics can be effectively applied at the micro level. Explains how the application of constructal theory can lead to more effective microsystems design Offers an introduction to the fundamentals and application to different flow and heat/mass transport systems Bridges the gap between theoretical design and optimization, from a practical point-of-view

The Upright Thinkers - Leonard Mlodinow 2016-04-19

How did a near-extinct species, eking out a meager existence with stone axes, become the dominant power on earth, able to harness a knowledge of nature ranging from tiny atoms to the vast structures of the universe? Leonard Mlodinow takes us on an enthralling tour of the history of human progress, from our time on the African savannah through the invention of written language, all the way to modern quantum physics. Along the way, he explores the colorful personalities of the great philosophers, scientists, and thinkers, and traces the cultural conditions—and the elements of chance—that influenced scientific discovery. Deeply informed, accessible, and infused with the author's trademark humor and insight, *The Upright Thinkers* is a stunning tribute to humanity's intellectual curiosity and an important book for any reader with an interest in the scientific issues of our day.

Handbook of Thermal Science and Engineering - 2018-07-18

This Handbook provides researchers, faculty, design engineers in industrial R&D, and practicing engineers in the field concise treatments of advanced and more-recently established topics in thermal science and engineering, with an important emphasis on micro- and nanosystems, not covered in earlier references on applied thermal science, heat transfer or relevant aspects of mechanical/chemical engineering. Major sections address new developments in heat transfer, transport phenomena, single- and multiphase flows with energy transfer, thermal-bioengineering, thermal radiation, combined mode heat transfer, coupled heat and mass transfer, and energy systems. Energy transport at the macro-scale and micro/nano-scales is also included. The internationally recognized team of authors adopt a consistent and systematic approach and writing style, including ample cross reference among topics, offering readers a user-friendly knowledgebase greater than the sum of its parts, perfect for frequent consultation. The Handbook of Thermal Science and Engineering is ideal for academic and professional readers in the traditional and emerging areas of mechanical engineering, chemical engineering, aerospace engineering, bioengineering, electronics fabrication, energy, and manufacturing concerned with the influence thermal phenomena.

Design in Nature - Adrian Bejan 2013-01-08

In this groundbreaking book, Adrian Bejan takes the recurring patterns in nature—trees, tributaries, air passages, neural networks, and lightning bolts—and reveals how a single principle of physics, the constructal law, accounts for the evolution of these and many other designs in our world. Everything—from biological life to inanimate systems—generates shape and structure and evolves in a sequence of ever-improving designs in order to facilitate flow. River basins, cardiovascular systems, and bolts of lightning are very efficient flow systems to move a current—of water, blood, or electricity. Likewise, the more complex architecture of animals evolve to cover greater distance per unit of useful energy, or increase their flow across the land. Such designs also appear in human organizations, like the hierarchical “flowcharts” or reporting structures in corporations and political bodies. All are governed by the same principle, known as

the constructal law, and configure and reconfigure themselves over time to flow more efficiently. Written in an easy style that achieves clarity without sacrificing complexity, *Design in Nature* is a paradigm-shifting book that will fundamentally transform our understanding of the world around us.

Shape and Structure, from Engineering to Nature - Adrian Bejan 2000-10-16

Seemingly universal geometric forms unite the flow systems of engineering and nature. For example, tree-shaped flows can be seen in computers, lungs, dendritic crystals, urban street patterns, and communication links. In this groundbreaking book, Adrian Bejan considers the design and optimization of engineered systems and discovers a deterministic principle of the generation of geometric form in natural systems. Shape and structure spring from the struggle for better performance in both engineering and nature. This idea is the basis of the new constructal theory: the objective and constraints principle used in engineering is the same mechanism from which the geometry in natural flow systems emerges. From heat exchangers to river channels, the book draws many parallels between the engineered and the natural world. Among the topics covered are mechanical structure, thermal structure, heat trees, ducts and rivers, turbulent structure, and structure in transportation and economics. The numerous illustrations, examples, and homework problems in every chapter make this an ideal text for engineering design courses. Its provocative ideas will also appeal to a broad range of readers in engineering, natural sciences, economics, and business.

Remarkable Reads - J. Peder Zane 2004

A fascinating collection of personal essays by writers who were inspired to sometimes life-altering actions through the written word includes contributions from Jonathan Lethem, Haven Kimmel, Charles Frazier, and Bebe Moore, among others. Original. 12,500 first printing.

Entropy Generation Minimization - Adrian Bejan 2013-10-29

This book presents the diverse and rapidly expanding field of Entropy Generation Minimization (EGM), the method of thermodynamic optimization of real devices. The underlying principles of the EGM method - also referred to as "thermodynamic optimization," "thermodynamic design," and "finite time thermodynamics" - are thoroughly discussed, and the method's applications to real devices are clearly illustrated. The EGM field has experienced tremendous growth during the 1980s and 1990s. This book places EGM's growth in perspective by reviewing both sides of the field - engineering and physics. Special emphasis is given to chronology and to the relationship between the more recent work and the pioneering work that outlined the method and the field. Entropy Generation Minimization combines the fundamental principles of thermodynamics, heat transfer, and fluid mechanics. EGM applies these principles to the modeling and optimization of real systems and processes that are characterized by finite size and finite time constraints, and are limited by heat and mass transfer and fluid flow irreversibilities. Entropy Generation Minimization provides a straightforward presentation of the principles of the EGM method, and features examples that elucidate concepts and identify recent EGM advances in engineering and physics. Modern advances include the optimization of storage by melting and solidification; heat exchanger design; power from hot-dry-rock deposits; the on & off operation of defrosting refrigerators and power plants with fouled heat exchangers; the production of ice and other solids; the maximization of power output in simple power plant models with heat transfer irreversibilities; the minimization of refrigerator power input in simple models; and the optimal collection and use of solar energy.

The Inventions, Researches and Writings of Nikola Tesla - Thomas Commerford Martin 1894

More than just descriptions and details, Thomas Martin attempts to explain in layman's terms the science behind Tesla's work. He has also included a short biography.?

Mindful Universe - Henry P. Stapp 2011-04-06

The classical mechanistic idea of nature that prevailed in science during the eighteenth and nineteenth centuries was an essentially mindless conception: the physically described aspects of nature were asserted to be completely determined by prior physically described aspects alone, with our conscious experiences entering only passively. During the twentieth century the classical concepts were found to be inadequate. In the new theory, quantum mechanics, our conscious experiences enter into the dynamics in specified ways not fixed by the physically described aspects alone. Consequences of this radical change in our understanding of the connection between mind and brain are described. This second edition contains two

new chapters investigating the role of quantum phenomena in the problem of free will and in the placebo effect.

Thermal Design and Optimization - Adrian Bejan 1995-12-12

A comprehensive and rigorous introduction to thermal system design from a contemporary perspective Thermal Design and Optimization offers readers a lucid introduction to the latest methodologies for the design of thermal systems and emphasizes engineering economics, system simulation, and optimization methods. The methods of exergy analysis, entropy generation minimization, and thermoeconomics are incorporated in an evolutionary manner. This book is one of the few sources available that addresses the recommendations of the Accreditation Board for Engineering and Technology for new courses in design engineering. Intended for classroom use as well as self-study, the text provides a review of fundamental concepts, extensive reference lists, end-of-chapter problem sets, helpful appendices, and a comprehensive case study that is followed throughout the text. Contents include: * Introduction to Thermal System Design * Thermodynamics, Modeling, and Design Analysis * Exergy Analysis * Heat Transfer, Modeling, and Design Analysis * Applications with Heat and Fluid Flow * Applications with Thermodynamics and Heat and Fluid Flow * Economic Analysis * Thermoeconomic Analysis and Evaluation * Thermoeconomic Optimization Thermal Design and Optimization offers engineering students, practicing engineers, and technical managers a comprehensive and rigorous introduction to thermal system design and optimization from a distinctly contemporary perspective. Unlike traditional books that are largely oriented toward design analysis and components, this forward-thinking book aligns itself with an increasing number of active designers who believe that more effective, system-oriented design methods are needed. Thermal Design and Optimization offers a lucid presentation of thermodynamics, heat transfer, and fluid mechanics as they are applied to the design of thermal systems. This book broadens the scope of engineering design by placing a strong emphasis on engineering economics, system simulation, and optimization techniques. Opening with a concise review of fundamentals, it develops design methods within a framework of industrial applications that gradually increase in complexity. These applications include, among others, power generation by large and small systems, and cryogenic systems for the manufacturing, chemical, and food processing industries. This unique book draws on the best contemporary thinking about design and design methodology, including discussions of concurrent design and quality function deployment. Recent developments based on the second law of thermodynamics are also included, especially the use of exergy analysis, entropy generation minimization, and thermoeconomics. To demonstrate the application of important design principles introduced, a single case study involving the design of a cogeneration system is followed throughout the book. In addition, Thermal Design and Optimization is one of the best news sources available for meeting the recommendations of the Accreditation Board for Engineering and Technology for more design emphasis in engineering curricula. Supported by extensive reference lists, end-of-chapter problem sets, and helpful appendices, this is a superb text for both the classroom and self-study, and for use in industrial design, development, and research. A detailed solutions manual is available from the publisher.

Natural Dog Training Kevin Behan 2009-01-14

Natural Dog Training is about how dogs see the world and what this means in regards to training. The first part of this book presents a new theory for the social behavior of canines, featuring the drive to hunt, not the pack instincts, as seminal to canine behavior. The second part reinterprets how dogs actually learn. The third section presents exercises and handling techniques to put this theory into practice with a puppy. The final section sets forth a training program with a special emphasis on coming when called.

Freedom and Evolution - Adrian Bejan 2019-12-06

The book begins with familiar designs found all around and inside us (such as the 'trees' of river basins, human lungs, blood and city traffic). It then shows how all flow systems are driven by power from natural engines everywhere, and how they are endlessly shaped because of freedom. Finally, Professor Bejan explains how people, like everything else that moves on earth, are driven by power derived from our "engines" that consume fuel and food, and that our movement dissipates the power completely and changes constantly for greater access, economies of scale, efficiency, innovation and life. Written for wide audiences of all ages, including readers interested in science, patterns in nature, similarity and non-uniformity, history and the future, and those just interested in having fun with ideas, the book shows how many "design

change" concepts acquire a solid scientific footing and how they exist with the evolution of nature, society, technology and science.

Convection Heat Transfer - Adrian Bejan 2013-03-28

A new edition of the bestseller on convection heat transfer A revised edition of the industry classic, Convection Heat Transfer, Fourth Edition, chronicles how the field of heat transfer has grown and prospered over the last two decades. This new edition is more accessible, while not sacrificing its thorough treatment of the most up-to-date information on current research and applications in the field. One of the foremost leaders in the field, Adrian Bejan has pioneered and taught many of the methods and practices commonly used in the industry today. He continues this book's long-standing role as an inspiring, optimal study tool by providing: Coverage of how convection affects performance, and how convective flows can be configured so that performance is enhanced How convective configurations have been evolving, from the flat plates, smooth pipes, and single-dimension fins of the earlier editions to new populations of configurations: tapered ducts, plates with multiscale features, dendritic fins, duct and plate assemblies (packages) for heat transfer density and compactness, etc. New, updated, and enhanced examples and problems that reflect the author's research and advances in the field since the last edition A solutions manual Complete with hundreds of informative and original illustrations, Convection Heat Transfer, Fourth Edition is the most comprehensive and approachable text for students in schools of mechanical engineering. *Your Dog Is Your Mirror* Kevin Behan 2012

Introduces the theory that a dog's behavior and emotion are driven by human emotion and dogs can be used to help their owners get in touch with their own feelings.

Atlas of Human Brain Connections - Marco Catani 2012-06-14

One of the major challenges of modern neuroscience is to define the complex pattern of neural connections that underlie cognition and behaviour. This atlas capitalises on novel diffusion MRI tractography methods to provide a comprehensive overview of connections derived from virtual in vivo tractography dissections of the human brain.

The Creative Destruction of Medicine - Eric Topol 2012-01-31

A professor of medicine reveals how technology like wireless internet, individual data, and personal genomics can be used to save lives.

Venomous - Christie Wilcox 2016-08-09

A thrilling tale of encounters with nature's masters of biochemistry From the coasts of Indonesia to the rainforests of Peru, venomous animals are everywhere—and often lurking out of sight. Humans have feared them for centuries, long considering them the assassins and pariahs of the natural world. Now, in *Venomous*, the biologist Christie Wilcox investigates and illuminates the animals of our nightmares, arguing that they hold the keys to a deeper understanding of evolution, adaptation, and immunity. She reveals just how venoms function and what they do to the human body. With Wilcox as our guide, we encounter a jellyfish with tentacles covered in stinging cells that can kill humans in minutes; a two-inch caterpillar with toxic bristles that trigger hemorrhaging; and a stunning blue-ringed octopus capable of inducing total paralysis. How do these animals go about their deadly work? How did they develop such intricate, potent toxins? Wilcox takes us around the world and down to the cellular level to find out. Throughout her journey, Wilcox meets the intrepid scientists who risk their lives studying these lethal beasts, as well as "self-immunizers" who deliberately expose themselves to snakebites. Along the way, she puts her own life on the line, narrowly avoiding being envenomated herself. Drawing on her own research, Wilcox explains how venom scientists are untangling the mechanisms of some of our most devastating diseases, and reports on pharmacologists who are already exploiting venoms to produce lifesaving drugs. We discover that venomous creatures are in fact keystone species that play crucial roles in their ecosystems and ours—and for this alone, they ought to be protected and appreciated. Thrilling and surprising at every turn, *Venomous* will change everything you thought you knew about the planet's most dangerous animals.

The Riverine Ecosystem Synthesis James H. Thorp 2010-07-27

This book presents the most comprehensive model yet for describing the structure and functioning of running freshwater ecosystems. Riverine Ecosystems Synthesis (RES) is a result of combining several theories published in recent decades, dealing with aquatic and terrestrial systems. New analyses are fused

with a variety of new perspectives on how river network ecosystems are structured and function, and how they change along longitudinal, lateral, and temporal dimensions. Among these novel perspectives is a dramatically new view of the role of hydrogeomorphic forces in forming functional process zones from headwaters to the mouths of great rivers. Designed as a useful tool for aquatic scientists worldwide whether they work on small streams or great rivers and in forested or semi-arid regions, this book will provide a means for scientists to understand the fundamental and applied aspects of rivers in general and includes a practical guide and protocols for analyzing individual rivers. Specific examples of rivers in at least four continents (Africa, Australia, Europe and North America) serve to illustrate the power and utility of the RES concept. Develops the classic, seminal article in *River Research and Applications*, "A Model of Biocomplexity in River Networks Across Space and Time" which introduced the RES concept for the first time A guide to the practical analysis of individual rivers, extending its use from pristine ecosystems to modern, human-modified rivers An essential aid both to the study fundamental and applied aspects of rivers, such as rehabilitation, management, monitoring, assessment, and flow manipulation of networks

Supernormal Stimuli: How Primal Urges Overran Their Evolutionary Purpose - Deirdre Barrett
2010-02-22

A Harvard psychologist explains how our once-helpful instincts get hijacked in our garish modern world. Our instincts—for food, sex, or territorial protection— evolved for life on the savannahs 10,000 years ago, not in today's world of densely populated cities, technological innovations, and pollution. We now have access to a glut of larger-than-life objects, from candy to pornography to atomic weapons—that gratify these gut instincts with often-dangerous results. Animal biologists coined the term "supernormal stimuli" to describe imitations that appeal to primitive instincts and exert a stronger pull than real things, such as soccer balls that geese prefer over eggs. Evolutionary psychologist Deirdre Barrett applies this concept to the alarming disconnect between human instinct and our created environment, demonstrating how supernormal stimuli are a major cause of today's most pressing problems, including obesity and war. However, Barrett does more than show how unfettered instincts fuel dangerous excesses. She also reminds us that by exercising self-control we can rein them in, potentially saving ourselves and civilization.

Building for Life - Stephen R. Kellert 2012-09-26

Sustainable design has made great strides in recent years; unfortunately, it still falls short of fully integrating nature into our built environment. Through a groundbreaking new paradigm of "restorative environmental design," award-winning author Stephen R. Kellert proposes a new architectural model of sustainability. In *Building For Life*, Kellert examines the fundamental interconnectedness of people and nature, and how the loss of this connection results in a diminished quality of life. This thoughtful new work illustrates how architects and designers can use simple methods to address our innate needs for contact with nature. Through the use of natural lighting, ventilation, and materials, as well as more unexpected methodologies—the use of metaphor, perspective, enticement, and symbol—architects can greatly enhance our daily lives. These design techniques foster intellectual development, relaxation, and physical and emotional well-being. In the works of architects like Frank Lloyd Wright, Eero Saarinen, Cesar Pelli, Norman Foster, and Michael Hopkins, Kellert sees the success of these strategies and presents models for moving forward. Ultimately, Kellert views our fractured relationship with nature as a design problem rather than an unavoidable aspect of modern life, and he proposes many practical and creative solutions for cultivating a more rewarding experience of nature in our built environment.

Advanced Engineering Thermodynamics - Adrian Bejan 2016-09-19

An advanced, practical approach to the first and second laws of thermodynamics *Advanced Engineering Thermodynamics* bridges the gap between engineering applications and the first and second laws of thermodynamics. Going beyond the basic coverage offered by most textbooks, this authoritative treatment delves into the advanced topics of energy and work as they relate to various engineering fields. This practical approach describes real-world applications of thermodynamics concepts, including solar energy, refrigeration, air conditioning, thermofluid design, chemical design, constructal design, and more. This new fourth edition has been updated and expanded to include current developments in energy storage, distributed energy systems, entropy minimization, and industrial applications, linking new technologies in sustainability to fundamental thermodynamics concepts. Worked problems have been added to help

students follow the thought processes behind various applications, and additional homework problems give them the opportunity to gauge their knowledge. The growing demand for sustainability and energy efficiency has shined a spotlight on the real-world applications of thermodynamics. This book helps future engineers make the fundamental connections, and develop a clear understanding of this complex subject. Delve deeper into the engineering applications of thermodynamics Work problems directly applicable to engineering fields Integrate thermodynamics concepts into sustainability design and policy Understand the thermodynamics of emerging energy technologies Condensed introductory chapters allow students to quickly review the fundamentals before diving right into practical applications. Designed expressly for engineering students, this book offers a clear, targeted treatment of thermodynamics topics with detailed discussion and authoritative guidance toward even the most complex concepts. *Advanced Engineering Thermodynamics* is the definitive modern treatment of energy and work for today's newest engineers.

Critique of Constructal Theory Tao Cheng 2019-09-12

Constructal theory has been extensively used to analyze and optimize many different shapes and structures in both living and non-living systems. It is generally considered to be a law that could govern the evolutions of shapes and structures in biology, physics, technology, and social organization. Accordingly, it seems that the constructal method is suitable for designing and analyzing all kinds of shapes and structures in the world. However, in most cases, the details for its applications were not carefully checked, meaning that it was often incorrectly applied, and that many unreasonable or inaccurate results were provided. This book systematically reviews and checks the applications of constructal theory in street design, economics, heat transfer optimization, flow systems, and explanations of natural structures and social phenomena. Every detail of the models, methods, optimizations, applications, results and conclusions is analysed, with careful consideration of theoretical derivations and typical examples. Accordingly, the problems and mistakes in the applications of the theory are directly pointed out and discussed in detail. The abuse and limitation of the constructal approach are also discussed. In many cases, it is shown that the theory has significant flaws and is even not applicable in certain circumstances. As constructal theory is widely used in the analysis and design of shapes and structures, this book will be essential for scientists, researchers, engineers, teachers, postgraduates and undergraduates in the fields of structure analysis, design and optimization in physics, biology, flow dynamics, heat transfer and thermodynamics.

The Physics of Life Adrian Bejan 2016-05-24

The Physics of Life illuminates the meaning of evolution in its broadest scientific sense and empowers the reader with a new view of the intertwined movement of all life - evolution is more than biological. The same physical effect is present in all patterns and flows - from life span and population growth, to air traffic, to government expansion, to the urge for better ideas, to sustainability. Evolution is everywhere, and the same elegant principles of physics apply to all things. Every animal and human wants power. From power comes movement: body movement, internal flow (pumping blood, and air), external flow (locomotion, migration), and the search for safety such as warmth, drinkable water, health, and the construction of highways and steel beams that do not break when we walk or drive on them. The growth and spread of civilisation is the flow of more power to more individuals, for greater movement. And everyone wants more power. That desire to improve, to organise, to join, to convince others, and to affect change is a trait we all share, and the freedom to change is what make all evolution not only possible but mandatory.

Cats' Paws and Catapults: Mechanical Worlds of Nature and People Steven Vogel 2000-01-17

"Full of ideas and well-explained principles that will bring new understanding of everyday things to both scientists and non-scientists alike."—R. McNeill Alexander, *Nature* Nature and humans build their devices with the same earthly materials and use them in the same air and water, pulled by the same gravity. Why, then, do their designs diverge so sharply? Humans, for instance, love right angles, while nature's angles are rarely right and usually rounded. Our technology goes around on wheels—and on rotating pulleys, gears, shafts, and cams—yet in nature only the tiny propellers of bacteria spin as true wheels. Our hinges turn because hard parts slide around each other, whereas nature's hinges (a rabbit's ear, for example) more often swing by bending flexible materials. In this marvelously surprising, witty book, Steven Vogel compares these two mechanical worlds, introduces the reader to his field of biomechanics, and explains how the nexus of physical law, size, and convenience of construction determine the designs of both people

and nature. "This elegant comparison of human and biological technology will forever change the way you look at each."—Michael LaBarbera, American Scientist

Constructal Law and the Unifying Principle of Design - Luiz A.O. Rocha 2015-01-28

Design happens everywhere, whether in animate objects (e.g., dendritic lung structures, bacterial colonies, and corals), inanimate patterns (river basins, beach slope, and dendritic crystals), social dynamics (pedestrian traffic flows), or engineered systems (heat dissipation in electronic circuitry). This “design in nature” often takes on remarkably similar patterns, which can be explained under one unifying Constructal Law. This book explores the unifying power of the Constructal Law and its applications in all domains of design generation and evolution, ranging from biology and geophysics to globalization, energy, sustainability, and security. The Constructal Law accounts for the universal tendency of flow systems to morph into evolving configurations that provide greater and easier access over time. The Constructal Law resolves the many and contradictory ad hoc statements of “optimality”, end design, and destiny in nature, such as minimum and maximum entropy production and minimum and maximum flow resistance, and also explains the designs that are observed and copied in biomimetics. Constructal Law and the Unifying Principle of Design covers the fundamentals of Constructal Theory and Design, as well as presenting a variety of state-of-the-art applications. Experts from the biological, physical and social sciences demonstrate the unification of all design phenomena in nature, and apply this knowledge to novel designs in modern engineering, such as vascularization for self-healing and self-cooling materials for aircraft, and tree fins and cavities for heat transfer enhancement.

Design in Nature - Adrian Bejan 2012-01-24

In this groundbreaking book, Adrian Bejan takes the recurring patterns in nature—trees, tributaries, air passages, neural networks, and lightning bolts—and reveals how a single principle of physics, the Constructal Law, accounts for the evolution of these and all other designs in our world. Everything—from biological life to inanimate systems—generates shape and structure and evolves in a sequence of ever-improving designs in order to facilitate flow. River basins, cardiovascular systems, and bolts of lightning are very efficient flow systems to move a current—of water, blood, or electricity. Likewise, the more complex architecture of animals evolve to cover greater distance per unit of useful energy, or increase their flow across the land. Such designs also appear in human organizations, like the hierarchical “flowcharts” or reporting structures in corporations and political bodies. All are governed by the same principle, known as the Constructal Law, and configure and reconfigure themselves over time to flow more efficiently. Written in an easy style that achieves clarity without sacrificing complexity, Design in Nature is a paradigm-shifting book that will fundamentally transform our understanding of the world around us.

The Tinkerer's Accomplish. Scott Turner 2009-06-30

Physiologist Scott Turner argues eloquently that the apparent design we see in the living world only makes sense when we add to Darwin's towering achievement the dimension that much modern molecular biology has left on the gene-splicing floor: the dynamic interaction between living organisms and their environment. Only when we add environmental physiology to natural selection can we begin to understand the beautiful fit between the form life takes and the way life works.

Constructal Law and the Unifying Principle of Design - Luiz A.O. Rocha 2012-12-04

Design happens everywhere, whether in animate objects (e.g., dendritic lung structures, bacterial colonies, and corals), inanimate patterns (river basins, beach slope, and dendritic crystals), social dynamics (pedestrian traffic flows), or engineered systems (heat dissipation in electronic circuitry). This “design in nature” often takes on remarkably similar patterns, which can be explained under one unifying Constructal Law. This book explores the unifying power of the Constructal Law and its applications in all domains of design generation and evolution, ranging from biology and geophysics to globalization, energy, sustainability, and security. The Constructal Law accounts for the universal tendency of flow systems to morph into evolving configurations that provide greater and easier access over time. The Constructal Law resolves the many and contradictory ad hoc statements of “optimality”, end design, and destiny in nature, such as minimum and maximum entropy production and minimum and maximum flow resistance, and also explains the designs that are observed and copied in biomimetics. Constructal Law and the Unifying Principle of Design covers the fundamentals of Constructal Theory and Design, as well as presenting a

variety of state-of-the-art applications. Experts from the biological, physical and social sciences demonstrate the unification of all design phenomena in nature, and apply this knowledge to novel designs in modern engineering, such as vascularization for self-healing and self-cooling materials for aircraft, and tree fins and cavities for heat transfer enhancement.

Porous and Complex Flow Structures in Modern Technologies - Adrian Bejan 2013-03-09

Porous and Complex Flow Structures in Modern Technologies represents a new approach to the field, considering the fundamentals of porous media in terms of the key roles played by these materials in modern technology. Intended as a text for advanced undergraduates and as a reference for practicing engineers, the book uses the physics of flows in porous materials to tie together a wide variety of important issues from such fields as biomedical engineering, energy conversion, civil engineering, electronics, chemical engineering, and environmental engineering. Thus, for example, flows of water and oil through porous ground play a central role in energy exploration and recovery (oil wells, geothermal fluids), energy conversion (effluents from refineries and power plants), and environmental engineering (leachates from waste repositories). Similarly, the demands of miniaturization in electronics and in biomedical applications are driving research into the flow of heat and fluids through small-scale porous media (heat exchangers, filters, gas exchangers). Filters, catalytic converters, the drying of stored grains, and a myriad of other applications involve flows through porous media. By providing a unified theoretical framework that includes not only the traditional homogeneous and isotropic media but also models in which the assumptions of representative elemental volumes or global thermal equilibrium fail, the book provides practicing engineers the tools they need to analyze complex situations that arise in practice. This volume includes examples, solved problems and an extensive glossary of symbols.

Steps to an Ecology of Mind - Gregory Bateson 2000-04-15

Gregory Bateson was a philosopher, anthropologist, photographer, naturalist, and poet, as well as the husband and collaborator of Margaret Mead. This classic anthology of his major work includes a new Foreword by his daughter, Mary Katherine Bateson. 5 line drawings.

The Nature of Motive Force Achintya Kumar Pramanick 2014-08-23

In this monograph Prof. Pramanick explicates the law of motive force, a fundamental law of nature that can be observed and appreciated as an addition to the existing laws of thermodynamics. This unmistakable and remarkable tendency of nature is equally applicable to all other branches of studies. He first conceptualized the law of motive force in 1989, when he was an undergraduate student. Here he reports various applications of the law in the area of thermodynamics, heat transfer, fluid mechanics and solid mechanics, and shows how it is possible to solve analytically century-old unsolved problems through its application. This book offers a comprehensive account of the law and its relation to other laws and principles, such as the generalized conservation principle, variational formulation, Fermat's principle, Bejan's constructal law, entropy generation minimization, Bejan's method of intersecting asymptotes and equipartition principle. Furthermore, the author addresses some interrelated fundamental problems of contemporary interest, especially to thermodynamicists, by combining analytical methods, physical reasoning and the proposed law of motive force. This foundational work is a valuable reading for both students and researchers in exact as well as non-exact sciences and, at the same time, a pleasant learning experience for the novice.

The Flow System - John Turner 2020-11-30

"The Flow System shows how to generate and nurture self-organizing teams that mobilize the full talents of those doing the work to cope with dizzying change and complexity, while also drawing on the contributions of those for whom the work is being done--the customers."--Steve Denning, author of The Age of Agile "Organizations that pull off this triple helix trick of thinking about the complexity of their systems and the environment in which they're operating, distributed leadership to engage the collective intelligence and creativity of the organization, and building teams of teams so the whole is greater than the sum of the parts, have a good chance of keeping up and staying ahead."--Steve Spear, MIT Sloan School senior lecturer, author of The High Velocity Edge "The Flow System's Triple Helix provides many of the tools and ways of thinking we will need to do that; it is agile without being doctrinaire about Agile."-- David Snowden, creator of the Cynefin Framework, Chief Scientific Officer of Cognitive Edge

Advanced Engineering Thermodynamics - Adrian Bejan 2016-09-06

An advanced, practical approach to the first and second laws of thermodynamics Advanced Engineering Thermodynamics bridges the gap between engineering applications and the first and second laws of thermodynamics. Going beyond the basic coverage offered by most textbooks, this authoritative treatment delves into the advanced topics of energy and work as they relate to various engineering fields. This practical approach describes real-world applications of thermodynamics concepts, including solar energy, refrigeration, air conditioning, thermofluid design, chemical design, constructal design, and more. This new fourth edition has been updated and expanded to include current developments in energy storage, distributed energy systems, entropy minimization, and industrial applications, linking new technologies in sustainability to fundamental thermodynamics concepts. Worked problems have been added to help students follow the thought processes behind various applications, and additional homework problems give

them the opportunity to gauge their knowledge. The growing demand for sustainability and energy efficiency has shined a spotlight on the real-world applications of thermodynamics. This book helps future engineers make the fundamental connections, and develop a clear understanding of this complex subject. Delve deeper into the engineering applications of thermodynamics Work problems directly applicable to engineering fields Integrate thermodynamics concepts into sustainability design and policy Understand the thermodynamics of emerging energy technologies Condensed introductory chapters allow students to quickly review the fundamentals before diving right into practical applications. Designed expressly for engineering students, this book offers a clear, targeted treatment of thermodynamics topics with detailed discussion and authoritative guidance toward even the most complex concepts. Advanced Engineering Thermodynamics is the definitive modern treatment of energy and work for today's newest engineers.