



[Books] Engineered Biomimicry

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Engineered Biomimicry-Akhlesh Lakhtakia 2013-05-24 Engineered Biomimicry covers a broad range of research topics in the emerging discipline of biomimicry. Biologically inspired science and technology, using the principles of math and physics, has led to the development of products as ubiquitous as Velcro™ (modeled after the spiny hooks on plant seeds and fruits). Readers will learn to take ideas and concepts like this from nature, implement them in research, and understand and explain diverse phenomena and their related functions. From bioinspired computing and medical products to biomimetic applications like artificial muscles, MEMS, textiles and vision sensors, Engineered Biomimicry explores a wide range of technologies informed by living natural systems. Engineered Biomimicry helps physicists, engineers and material scientists seek solutions in nature to the most pressing technical problems of our times, while providing a solid understanding of the important role of biophysics. Some physical applications include adhesion superhydrophobicity and self-cleaning, structural coloration, photonic devices, biomaterials and composite materials, sensor systems, robotics and locomotion, and ultra-lightweight structures. Explores biomimicry, a fast-growing, cross-disciplinary field in which researchers study biological activities in nature to make critical advancements in science and engineering Introduces bioinspiration, biomimetics, and bioreplication, and provides biological background and practical applications for each Cutting-edge topics include bio-inspired robotics, microflyers, surface modification and more

Engineered Biomimicry-Torben Lenau 2013-05-24 Self-organization and self-healing appeal to humans because difficult and repeated actions can be avoided through automation via bottom-up nonhierarchical processes. This is in contrast to the top-level controlled manner we normally apply as an action strategy in manufacturing and maintenance work. This chapter presents eight different self-organizing and self-healing approaches in nature and takes a look at realized and potential applications. Furthermore, the core principles for each approach are described using simplified drawings in order to make the ideas behind the self-organizing and self-healing principles more accessible to design practitioners.

Engineered Biomimicry-Natalia Dushkina 2013-05-24 Structural colors originate in the scattering of light from ordered microstructures, thin films, and even irregular arrays of electrically small particles, but they are not produced by pigments. Examples include the flashing sparks of colors in opals and the brilliant hues of some butterflies such as Morpho rhetenor. Structural colors can be implemented industrially to produce structurally colored paints, fabrics, cosmetics, and sensors.

Engineered Biomimicry-Akhlesh Lakhtakia 2013 Engineered Biomimicry covers a broad range of research topics in the emerging discipline of biomimicry. Biologically inspired science and technology, using the principles of math and physics, has led to the development of products as ubiquitous as Velcro™ (modeled after the spiny hooks on plant seeds and fruits). Readers will learn to take ideas and concepts like this from nature, implement them in research, and understand and explain diverse phenomena and their related functions. From bioinspired computing and medical products to biomimetic applications like artificial muscles, MEMS, textiles and vision sensors, Engineered Biomimicry explores a wide range of technologies informed by living natural systems. Engineered Biomimicry helps physicists, engineers and material scientists seek solutions in nature to the most pressing technical problems of our times, while providing a solid understanding of the important role of biophysics. Some physical applications include adhesion superhydrophobicity and self-cleaning, structural coloration, photonic devices, biomaterials and composite materials, sensor systems, robotics and locomotion, and ultra-lightweight structures. Explores biomimicry, a fast-growing, cross-disciplinary field in which researchers study biological activities in nature to make critical advancements in science and engineering Introduces bioinspiration, biomimetics, and bioreplication, and provides biological background and practical applications for each Cutting-edge topics include bio-inspired robotics, microflyers, surface modification and more

Engineered Biomimicry-Michael S. Ellison 2013-05-24 In a sense, the archetype of bioinspiration for materials design and use is textiles. The field of biomimesis has spawned many new materials and continues to be a fruitful field of investigation. This chapter presents the current state of bioinspiration in textiles, how this has resulted in improved fibrous materials, how it may inform our continued progress. Because I have found many preconceived notions about the field that need addressing before the application of biomimetics to textiles can be truly appreciated, I begin with an introduction to textiles. Next, naturally enough, the discipline of biomimesis is introduced and then fleshed out in terms of its textile engineering importance. Following this, some details on fiber and textile science and engineering are discussed and biological concepts germane to our topic are presented. In the last step in this journey, the marriage of biomimesis and textiles is performed and some consequences revealed. Finally, I offer some prognostications on the topic.

Engineered Biomimicry-Ranjan Vepa 2013-05-24 Some basic features of biomimetic robotics and the technologies that are facilitating their development are discussed in this chapter. The emergence of smart materials and structures, smart sensors and actuators capable of mimicking biological transducers, bio-inspired signal-processing techniques, modeling and control of manipulators resembling biological limbs, and the shape control of flexible systems are the primary areas in which recent technological advances have taken place. Some key applications of these technological developments in the design of morphing airfoils, modeling and control of anthropomorphic manipulators and muscle activation modeling, and control for human limb prosthetic and orthotic applications are discussed. Also discussed, with some typical examples, are the related developments in the application of nonlinear optimal control and estimation, which are fundamental to the success of biomimetic robotics.

Engineered Biomimicry-Javaan Chahl 2013-05-24 Insects are dependent on the spatial, spectral, and temporal distributions of light in the environment for flight control and navigation. This chapter reports on flight trials of implementations of insect-inspired behaviors on unmanned aerial vehicles. Optical-flow methods for maintaining a constant height above ground and a constant course have been demonstrated to provide navigational capabilities that are impossible using conventional avionics sensors. Precision control of height above ground and ground course were achieved over long distances. Other demonstrated vision-based techniques include a biomimetic stabilization sensor that uses the ultraviolet and green bands of the spectrum and a sky polarization compass. Both of these sensors were tested over long trajectories in different directions, in each case showing performance similar to low-cost inertial heading and attitude systems.

Engineered Biomimicry-Aditi S. Risbud 2013-05-24 Nature generates structurally complex architectures with feature sizes covering several length scales under rather simple environmental conditions and with limited resources. Today, researchers understand how many of these structures look and behave, but, in many instances, we still lack nature's ability to marry elegant structures with complex functionality. By unraveling the wonders of nature's design, scientists have developed biomimetic and biotemplated materials with entirely new functions and behaviors. In particular, solution-based methods provide simple, inexpensive routes to generating bioreplicated structures. In this chapter, we survey solution-based bioreplication methods and provide an example for generating three-dimensional photonic crystal structures based on colored weevil scales. This example illustrates how structural engineering in biology can be replicated using sol-gel chemistry and results in an entirely new optical material with fascinating properties.

Engineered Biomimicry-Raúl J. Martín-Palma 2013-05-24 The term vapor deposition encompasses a large palette of techniques essential for both the reproduction of certain structural features of a biotemplate and the replication of a biotemplate. Physical vapor deposition, chemical vapor deposition, atomic layer deposition, and molecular beam epitaxy are succinctly described in this chapter in the context of engineered biomimicry.

Bioinspiration and Biomimicry in Chemistry-Gerhard Swiegers 2012-09-17 Can we emulate nature's

technology in chemistry? Through billions of years of evolution, Nature has generated some remarkable systems and substances that have made life on earth what it is today. Increasingly, scientists are seeking to mimic Nature's systems and processes in the lab in order to harness the power of Nature for the benefit of society. Bioinspiration and Biomimicry in Chemistry explores the chemistry of Nature and how we can replicate what Nature does in abiological settings. Specifically, the book focuses on wholly artificial, man-made systems that employ or are inspired by principles of Nature, but which do not use materials of biological origin. Beginning with a general overview of the concept of bioinspiration and biomimicry in chemistry, the book tackles such topics as: Bioinspired molecular machines Bioinspired catalysis Biomimetic amphiphiles and vesicles Biomimetic principles in macromolecular science Biomimetic cavities and bioinspired receptors Biomimicry in organic synthesis Written by a team of leading international experts, the contributed chapters collectively lay the groundwork for a new generation of environmentally friendly and sustainable materials, pharmaceuticals, and technologies. Readers will discover the latest advances in our ability to replicate natural systems and materials as well as the many impediments that remain, proving how much we still need to learn about how Nature works. Bioinspiration and Biomimicry in Chemistry is recommended for students and researchers in all realms of chemistry. Addressing how scientists are working to reverse engineer Nature in all areas of chemical research, the book is designed to stimulate new discussion and research in this exciting and promising field.

Nature Did It First-Karen Ansberry 2020 "Part playful poetry, part nonfiction information, children are introduced to the unique structures of seven plants and animals and the extraordinary innovations they have inspired."--

Interdisciplinary Expansions in Engineering and Design With the Power of Biomimicry-Gulden Kokturk 2018-03-28 People have been finding inspiration in nature in solving their problems, from the very beginning of their existence. In the most general sense, biomimicry, defined as "inspire from the nature," has brought together the engineers and designers nowadays. This collaboration creates innovative and creative outcomes that encourage people with their interdisciplinary relationships. Accordingly, the aim of this book is to bring together different works or developments on biomimetics in interdisciplinary relationship between different areas, especially biomimicry, engineering, and design. The twenty-first century has conceived many new and amazing designs. The book in your hands will surely be an important guide to take a quick look at the future possibilities.

Biomimicry-Janine M. Benyus 2009-08-11 Repackaged with a new Afterword, this "valuable and entertaining" (New York Times Book Review) book explores how scientists are adapting nature's best ideas to solve tough 21st century problems Biomimicry is rapidly transforming life on earth. Biomimics study nature's most successful ideas over the past 3.5 million years, and adapt them for human use. The results are revolutionizing how materials are invented and how we compute, heal ourselves, repair the environment, and feed the world. Janine Benyus takes readers into the lab and in the field with maverick thinkers as they: discover miracle drugs by watching what chimps eat when they're sick; learn how to create by watching spiders weave fibers; harness energy by examining how a leaf converts sunlight into fuel in trillionths of a second; and many more examples. Composed of stories of vision and invention, personalities and pipe dreams, Biomimicry is must reading for anyone interested in the shape of our future.

Biomimetic Principles and Design of Advanced Engineering Materials-Zhenhai Xia 2016-08-29 This book explores the structure-property-process relationship of biomaterials from engineering and biomedical perspectives, and the potential of bio-inspired materials and their applications. A large variety of natural materials with outstanding physical and mechanical properties have appeared in the course of evolution. From a bio-inspired viewpoint, materials design requires a novel and highly cross disciplinary approach. Considerable benefits can be gained by providing an integrated approach using bio-inspiration with materials science and engineering. The book is divided into three parts; Part One focuses on mechanical aspects, dealing with conventional material properties: strength, toughness, hardness, wear resistance, impact resistance, self-healing, adhesion, and adaptation and morphing. Part Two focuses on functional materials with unique capabilities, such as self-cleaning, stimuli-response, structural color, anti-reflective materials, catalytic materials for clean energy conversion and storage, and other related topics. Part Three describes how to mimic natural materials processes to synthesize materials with low cost, efficient and environmentally friendly approaches. For each chapter, the approach is to describe situations in nature first and then biomimetic materials, fulfilling the need for an interdisciplinary approach which overlaps both engineering and materials science.

Biomimetics-Yoseph Bar-Cohen 2005-11-02 Nature is the world's foremost designer. With billions of years of experience and boasting the most extensive laboratory available, it conducts research in every branch of engineering and science. Nature's designs and capabilities have always inspired technology, from the use of tongs and tweezers to genetic algorithms and autonomous legged robots. Taking a systems perspective rather than focusing narrowly on materials or chemistry aspects, Biomimetics: Biologically Inspired Technologies examines the field from every angle. The book contains pioneering approaches to biomimetics including a new perspective on the mechanization of cognition and intelligence, as well as defense and attack strategies in nature, their applications, and potential. It surveys the field from modeling to applications and from nano- to macro-scales, beginning with an introduction to principles of using biology to inspire designs as well as biological mechanisms as models for technology. This innovative guide discusses evolutionary robotics; genetic algorithms; molecular machines; multifunctional, biological-, and nano- materials; nastic structures inspired by plants; and functional surfaces in biology. Looking inward at biological systems, the book covers the topics of biomimetic materials, structures, control, cognition, artificial muscles, biosensors that mimic senses, artificial organs, and interfaces between engineered and biological systems. The final chapter contemplates the future of the field and outlines the challenges ahead. Featuring extensive illustrations, including a 32-page full-color insert, Biomimetics: Biologically Inspired Technologies provides unmatched breadth of scope as well as lucid illumination of this promising field.

Biomimicry and Business-Margo Farnsworth 2020-10-21 Biomimicry, the practice of observing then mimicking nature's strategies to solve business challenges, offers a path to healthy profit while working in partnership, and even reciprocity, with the natural world. Other books have described biomimicry, its uses, and its benefits. This book shows readers how to create their own biomimetic or bioinspired solutions with clear benefits to the bottom line, the environment, and people. Fashioned through storytelling, this book blends snapshots of five successful companies - Nike, Interface, Inc., PAX Scientific, Sharklet Technologies, and Encycle - which decided to partner with nature by deploying biomimicry. The book details how they discovered the practices, introduced them to staff, engaged in the process, and measured outcomes. The book concludes with challenges for readers to determine their own next steps in business and offers practical and useful resources to get there. By revealing the stories of each professional's journey with lessons they learned, then providing resources and issuing a challenge and pathway to do business better, this book serves as a tool for entrepreneurs, seasoned professionals, and students to emulate nature's brilliance, apply it at work, and contribute to a healthier, more prosperous world.

Biomimicry for Optimization, Control, and Automation-Kevin M. Passino 2005-12-06 Biomimicry uses our scientist's understanding of biological systems to exploit ideas from nature in order to construct some technology. In this book, we focus on how to use biomimicry for the functional operation of the "hardware and software" of biological systems for the development of optimization algorithms and feedback control systems that extend our capabilities to implement sophisticated levels of automation. The primary focus is not on the modeling, emulation, or analysis of some biological system. The focus is on using "bio-inspiration" to inject new ideas, techniques, and perspective into the engineering of complex automation systems. There are many biological processes that, at some level of abstraction, can be represented as optimization processes, many of which have as a basic purpose automatic control, decision making, or automation. For instance, at the level of everyday experience, we can view the actions of a human operator of some process (e. g. , the driver of a car) as being a series of the best choices he or she makes in trying to achieve some goal (staying on the road); emulation of this decision-making process amounts to modeling a type of biological optimization and decision-making process, and implementation of the resulting algorithm results in

“human mimicry” for automation. There are clearer examples of - logical optimization processes that are used for control and automation when you consider nonhuman biological or behavioral processes, or the (internal) - ology of the human and not the resulting external behavioral characteristics (like driving a car). For instance, there are homeostasis processes where, for instance, temperature is regulated in the human body.

Engineering Education for the Next Generation: A Nature-Inspired Approach-Samuel Cord Stier 2020-03-10 Guide your students through the fascinating world of engineering, and how to draw inspiration from Nature’s genius to create, make, and innovate a better human-built world. Studded with more than 150 illustrations of natural phenomena and engineering concepts, this fascinating and practical book clearly demonstrates how engineering design is broadly relevant for all students, not just those who may become scientists or engineers. Mr. Stier describes clever, engaging activities for students at every grade level to grasp engineering concepts by exploring the everyday design genius of the natural world around us. Students will love learning about structural engineering while standing on eggs; investigating concepts in sustainable design by manufacturing cement out of car exhaust; and coming to understand how ant behavior has revolutionized the way computer programs, robots, movies, and video games are designed today. You will come away with an understanding of engineering and Nature unlike any you’ve had before, while taking your ability to engage students to a whole new level. Engineering Education for the Next Generation is a wonderful introduction to the topic for any teacher who wants to understand more about engineering design in particular, its relation to the larger subjects of STEM/STEAM, and how to engage students from all backgrounds in a way that meaningfully transforms their outlook on the world and their own creativity in a lifelong way. · Fun to read, comprehensive exploration of cutting-edge approaches to K-12 engineering education · Detailed descriptions and explanations to help teachers create activities and lessons · An emphasis on engaging students with broad and diverse interests and backgrounds · Insights from a leading, award-winning K-12 engineering curriculum that has reached thousands of teachers and students in the U.S. and beyond · Additional support website (www.LearningWithNature.org) providing more background, videos, curricula, slide decks, and other supplemental materials

Biomimetics-Sandy B. Primrose 2020-09-29 Provides a professional, contemporary, and concise review of the current knowledge and advances in biomimetics This book covers the field of biomimicry, an area of science where researchers look to mimic aspects of plants or animals in order to solve problems in aerospace, shipping, building, electronics, and optics, among others. It presents the latest developments in biomimicry and gives readers sufficient grounding to help them understand the current, and sometimes technically complex, research literature. Different themes are covered throughout and text boxes deal with the relevant physics for readers who may lack this knowledge. Biomimetics: Nature-Inspired Design and Innovation examines issues in fluid dynamics such as avoiding sonic booms, reducing train noise, increasing wind turbine efficiency, and more. Next, it looks at optical applications, e.g. how nature generates color without dyes and pigment, and how animals stay cool in desert environments. A chapter on the built environment discusses cooling systems for buildings based on termite mounds; creating self-cleaning paint based on lotus leaves; unobtrusive solar panels based on ivy; and buildings that respond to the environment. Two more sections focus on biomimicry for the creation of smart materials and smart devices. The book finishes with a look at the field’s future over the next decade. Presents each topic in sufficient detail in order to enable the reader to comprehend the original scientific papers Emphasizes those examples of biomimicry that have made it into products Features text boxes that provide information on the relevant physics or engineering principles for biologists who do not have a physics background Covers the scientific literature up to July 2019 Biomimetics: Nature-Inspired Design and Innovation is an excellent book for senior undergraduates and post-graduate students in the life sciences, material sciences, and bioengineering. It will also appeal to lay readers with an interest in nature as well as scientists in general.

Biotechnologies and Biomimetics for Civil Engineering-Fernando Pacheco Torgal 2014-08-16 Putting forward an innovative approach to solving current technological problems faced by human society, this book encompasses a holistic way of perceiving the potential of natural systems. Nature has developed several materials and processes which both maintain an optimal performance and are also totally biodegradable, properties which can be used in civil engineering. Delivering the latest research findings to building industry professionals and other practitioners, as well as containing information useful to the public, ‘Biotechnologies and Biomimetics for Civil Engineering’ serves as an important tool to tackle the challenges of a more sustainable construction industry and the future of buildings.

Biomimetics-Yoseph Bar-Cohen 2016-04-19 Mimicking nature - from science fiction to engineering reality Humans have always looked to nature’s inventions as a source of inspiration. The observation of flying birds and insects leads to innovations in aeronautics. Collision avoidance sensors mimic the whiskers of rodents. Optimization algorithms are based on survival of the fittest, the seed-picking process of pigeons, or the behavior of ant colonies. In recent years these efforts have become more intensive, with researchers seeking rules, concepts, and principles of biology to inspire new possibilities in materials, mechanisms, algorithms, and fabrication processes. A review of the current state of the art, Biomimetics: Nature Based Innovation documents key biological solutions that provide a model for innovations in engineering and science. Leading experts address a wide range of topics, including: Artificial senses and organs Mimicry at the cell-materials interface Multiscale modeling of plant cell wall architecture and tissue mechanics The making of biomimetic composites Electroactive polymer (EAP) actuators as artificial muscles EAP-based refreshable braille displays Biomimetic optics from the angles of biology and plants Biomimicry of flying birds, insects, and marine biology Applications of biomimetics in manufacturing, products, and medicine Robotics, including the development of human-like robots Biologically inspired design as a tool for interdisciplinary education The biomimetic process in artistic creation The final chapter outlines the challenges to biomimetic-related innovation and offers a vision for the future. A follow-up to Biomimetics: Biologically Inspired Technologies (2005), this comprehensive reference methodically surveys the latest advances in this rapidly emerging field. It features an abundance of illustrations, including a 32-page full-color insert, and provides extensive references for engineers and scientists interested in delving deeper into the study of biomimetics.

Biomimetic Architectures by Plasma Processing-Surojit Chattopadhyay 2014-12-16 Plasma-processed biomimetic structures are an extremely focused and small subset of biomimetics. Although other methods can also be adopted, experimental synthesis of biomimetic structures mainly focuses on plasma processing. This book deals with the theoretical description of photonic structures available in nature, and the physics and applications of biomimetic structures prepared in the laboratory. It discusses anti-reflection properties of moth eye- or cicada wing-type nanostructured materials on semiconductor surfaces, with emphasis on plasma fabrication procedures. It also explains, with the help of related theories, the superhydrophobic or hydrophilic wetting properties demonstrated by most of these natural structures. It discusses biomedical applications, especially in implants, as one of the key applications of such materials. The book focuses mainly on plasma processing of biomimetic nanostructures and is, therefore, different from similar books that are more general in nature. It presents essential schematics, sufficient details, and advanced instrumentation techniques that would help readers understand why these structures are considered so important in materials science and physics.

Biomimetic Design Method for Innovation and Sustainability-Yael Helfman Cohen 2016-07-01 Presenting a novel biomimetic design method for transferring design solutions from nature to technology, this book focuses on structure-function patterns in nature and advanced modeling tools derived from TRIZ, the theory of inventive problem-solving. The book includes an extensive literature review on biomimicry as an engine of both innovation and sustainability, and discusses in detail the biomimetic design process, current biomimetic design methods and tools. The structural biomimetic design method for innovation and sustainability put forward in this text encompasses (1) the research method and rationale used to develop and validate this new design method; (2) the suggested design algorithm and tools including the Find structure database, structure-function patterns and ideality patterns; and (3) analyses of four case studies describing how to use the proposed method. This book offers an essential resource for designers who wish to use nature as a source of inspiration and knowledge, innovators and sustainability experts, and scientists and researchers, amongst others.

Biomimicry Resource Handbook-Dayna Baumeister 2014-12-11 The Biomimicry Resource Handbook: A Seed Bank of Best Practices contains over 250 pages of our most current biomimicry thinking, methodology, and tools for naturalizing biomimicry into the culture. We believe there is no better design partner than nature. But biomimicry is more than just looking at the shape of a flower or dragonfly and becoming newly inspired; it’s a methodology that’s being used by some of the biggest companies and innovative universities in the world. While reading this text you’ll be immersed into the world of Biomimicry the “verb”, you’ll gain a competitive edge, and a fresh perspective on how the world around us can, does, and should work. After reading the text, you’ll be well on your way to thinking in systems, designing in context, identifying patterns, and most importantly seeing the millions of organisms around us....differently. The text is directly applicable to designers, biologists, engineers, entrepreneurs and intrapreneurs, but has also proven valuable to students, educators, and a wide variety of other disciplines. Visit biomimicry.net to learn more. A digital version is available at shop.biomimicrygroup.com

The Shark’s Paintbrush-Jay Harman 2013-06-25 The wave of the future has been around since the beginning of times: it’s called Nature. Let inventor and entrepreneur Jay Harman introduce you to stunning solutions to some of the world’s thorniest problems. Why does the bumblebee have better aerodynamics than a 747? How can copying a butterfly wing reduce the world’s lighting energy bill by 80%? How will fleas’ knees and bees’ shoulders help scientists formulate a near-perfect rubber? Today an interdisciplinary and international group of scientists, inventors and engineers is turning to nature to innovate and find elegant solutions to human problems. The principle driving this transformation is called biomimicry, and Harman shares a wide range of examples of how we’re borrowing from natural models to invent profitable, green solutions to pressing industrial challenges. Aimed at a business audience, aspiring entrepreneurs, environmentalists and general science readers, The Shark’s Paintbrush reflects a force of change in the new global economy that does more than simply gratify human industrial ambition; it teaches us how to live in harmony with nature and opens bright opportunities for a better future.

Biomimetics in Photonics-Olaf Karthaus 2012-10-26 Biomimetic photonics is a burgeoning field. Biologists are finding and describing a whole menagerie of unique and astonishingly complex nano- and microstructures in fauna and flora. Material scientists are developing novel multifunctional and hierarchical structures with a wide variety of post-nano era photonics applications. Mathematicians and computer scientists are using computer models and simulations to understand the underlying principles of biomimetic structures. However, concepts, structures, and phenomena that are well known in one community are quite unknown in others. Exploring a biomimetic approach to developing photonic devices and structures, Biomimetics in Photonics discusses not only the role of and results of biomimicry in engineering, but also the true understanding of natural processes and the application of these techniques to established technologies. Featured Topics Photonic structures in flowers, leaves and fruits and inorganic structures produced in aquatic environment by diatoms, sponges, and shells Mechanisms for biomineralization and how natural structures can be synthetically modified or even used as templates for artificial photonic materials Biological photonic structures in beetles and butterflies and their bio-inspired applications, including anti-reflecting surfaces, iridescent viruses, light reflection, metallic effects, and infrared sensors Suitable for researchers and graduate students, the book does more than describe how to extract good design from nature—Biomimetics in Photonics highlights natural design techniques in context, allowing for a more complete modeling picture. It demonstrates the possibilities and challenges in the move from a laboratory environment to industrial scale production of biomimetic photonic structures.

Biomimicry in Architecture-Michael Pawlyn 2019-08-12 When searching for genuinely sustainable building design and technology - designs that go beyond conventional sustainability to be truly restorative - we often find that nature got there first. Over 3.5 billion years of natural history have evolved innumerable examples of forms, systems, and processes that can be applied to modern green design. For architects, urban designers and product designers, this new edition of Biomimicry in Architecture looks to the natural world to achieve radical increases in resource efficiency. Packed with case studies predicting future trends, this edition also contains updated and expanded chapters on structures, materials, waste, water, thermal control and energy, as well as an all-new chapter on light. An amazing sourcebook of extraordinary design solutions, Biomimicry in Architecture is a must-read for anyone preparing for the challenges of building a sustainable and restorative future.

Biomimetic Research for Architecture and Building Construction-Jan Knippers 2016-12-19 This book comprises a first survey of the Collaborative Research Center SFB-TRR 141 ‘Biological Design and Integrative Structures - Analysis, Simulation and Implementation in Architecture’, funded by the Deutsche Forschungsgemeinschaft since October 2014. The SFB-TRR 141 provides a collaborative framework for architects and engineers from the University of Stuttgart, biologists and physicists from the University of Freiburg and geoscientists and evolutionary biologists from the University of Tübingen. The programm is conceptualized as a dialogue between the disciplines and is based on the belief that that biomimetic research has the potential to lead everyone involved to new findings far beyond his individual reach. During the last few decades, computational methods have been introduced into all fields of science and technology. In architecture, they enable the geometric differentiation of building components and allow the fabrication of porous or fibre-based materials with locally adjusted physical and chemical properties. Recent developments in simulation technologies focus on multi-scale models and the interplay of mechanical phenomena at various hierarchical levels. In the natural sciences, a multitude of quantitative methods covering diverse hierarchical levels have been introduced. These advances in computational methods have opened a new era in biomimetics: local differentiation at various scales, the main feature of natural constructions, can for the first time not only be analysed, but to a certain extent also be transferred to building construction. Computational methodologies enable the direct exchange of information between fields of science that, until now, have been widely separated. As a result they lead to a new approach to biomimetic research, which, hopefully, contributes to a more sustainable development in architecture and building construction.

Biomimetic Biomaterials-Andrew J Ruys 2013-09-30 A significant proportion of modern medical technology has been developed through biomimetics, which is biologically inspired by studying pre-existing functioning systems in nature. Typical biomimetically inspired biomaterials include nano-biomaterials, smart biomaterials, hybrid biomaterials, nano-biocomposites, hierarchically porous biomaterials and tissue scaffolds. This important book summarises key research in this important field. The book is divided into two parts: Part one is devoted to the biomimetics of biomaterials themselves while part two provides overviews and case studies of tissue engineering applications from a biomimetics’ perspective. The book has a strong focus on cutting edge biomimetically inspired biomaterials including chitin, hydrogels, calcium phosphates, biopolymers and anti-thrombotic coatings. Since many scaffolds for skin tissue engineering are biomimetically inspired, the book also has a strong focus on the biomimetics of tissue engineering in the repair of bone, skin, cartilage, soft tissue and specific organs. With its distinguished editor and international team of contributors, Biomimetic biomaterials is a standard reference for both the biomaterials research community and clinicians involved in such areas as bone regeneration, skin tissue and wound repair. Places strong focus on cutting edge biomimetically-inspired biomaterials including chitin, hydrogels, calcium phosphates, biopolymers and anti-thrombotic coatings Provides overviews and case studies of tissue engineering applications from a biomimetics perspective Also places focus on the biomimetics of tissue engineering in the repair of bone, skin, cartilage, soft tissue and specific organs

Wild Buildings and Bridges-Etta Kaner 2018-10-02 The surprising ways nature has influenced architecture. It may come as a surprise to learn that architects have found solutions to all kinds of design challenges in nature! Some have looked to nature to solve a structural problem, like creating an earthquake-proof bridge by mimicking the extremely long roots of a special type of grass. Others have turned to nature for artistic inspiration, designing buildings and bridges that evoke the movement of swimming fish or a bird in flight. When it comes to style and structure, nature and architecture make perfect partners! From cactuses to birdsé wings, termite towers to honeycombs, inspiration for ingenious design is everywhere around us!

Regenerative Urban Design and Ecosystem Biomimicry-Maibritt Pedersen Zari 2018-05-20 It is clear that the climate is changing and ecosystems are becoming severely degraded. Humans must mitigate the causes of, and adapt to, climate change and the loss of biodiversity, as the impacts of these changes become more apparent and demand urgent responses. These pressures, combined with rapid global urbanisation and population growth mean that new ways of designing, retrofitting and living in cities are critically needed. Incorporating an understanding of how the living world works and what ecosystems do into architectural and urban design is a step towards the creation and evolution of cities that are radically more sustainable and potentially regenerative. Can cities produce their own food, energy, and water? Can they be designed to regulate climate, provide habitat, cycle nutrients, and purify water, air and soil? This book examines and defines the field of biomimicry for sustainable built environment design and goes on to translate ecological knowledge into practical methodologies for architectural and urban design that can proactively respond to climate change and biodiversity loss. These methods are tested and exemplified through a series of case studies of existing cities in a variety of climates. Regenerative Urban Design and Ecosystem Biomimicry will be of great interest to students, professionals and researchers of architecture, urban design, ecology, and environmental studies, as well as those interested in the interdisciplinary study of sustainability, ecology and urbanism.

Biomimicry-Seraphine Menu 2020-12-01 Nature did it first! A beautiful and whimsically illustrated explanation of cool inventions like Velcro and scuba suits that were inspired by the natural world Discover how bats led to the development of radar, whales inspired the pacemaker, and the lotus flower may help us produce indestructible clothing. "Biomimicry" comes from the Greek "bio" (life) and "mimesis" (imitation)." Here are various and amazing ways that nature inspires us to create cool inventions in science and medicine, clothing design, and architecture. From the fireflies that showed inventors how LEDs could give off more light to the burdock plant that inspired velcro to the high speed trains of Japan that take the form of a kingfisher’s sleek, aerodynamic head, there are innumerable ways that we can create smarter, better, safer inventions by observing the natural world. Author

Seraphine Menu and illustrator Emmanuelle Walker also gently explain that our extraordinary, diverse, and awe-inspiring world is like a carefully calibrated machine and its fragile balance must be treated with extreme care and respect. "Go outside," they say, "observe, compare, and maybe some day you'll be the next person to be struck by a great idea."

Biologically Inspired Design-Torben A. Lenau 2021-01-15 As the existence of all life forms on our planet is currently in grave danger from the climate emergency caused by Homo sapiens, the words "sustainability" and "eco-responsibility" have entered the daily-use vocabularies of scientists, engineers, economists, business managers, industrialists, capitalists, and policy makers. Normal activities undertaken for the design of products and systems in industrialisms must be revamped. As the bioworld is a great resource for eco-responsible design activities, an overview of biologically inspired design is presented in this book in simple terms for anyone with even high-school education. Beginning with an introduction to the process of design in industry, the book presents the bioworld as a design resource along with the rationale for biologically inspired design. Problem-driven and solution-driven approaches for biologically inspired design are described next. The last chapter is focused on biologically inspired design for environment.

Optical Biomimetics-Maryanne Large 2012-09-24 Optical biomimetics, the study of natural systems to inspire novel solutions to problems in optical technologies, has attracted growing interest. Optical biomimetics reviews key research in this area, focusing on the techniques and approaches used to characterise and mimic naturally occurring optical effects. Beginning with an overview of natural photonic structures, Optical biomimetics goes on to discuss optical applications of biomolecules, such as retinylidene and bacteriorhodopsin, polarisation effects in natural photonic structures and their applications, and biomimetic nanostructures for anti-reflection (AR) devices. Control of iridescence in natural photonic structures is explored through the case of butterfly scales, alongside a consideration of nanostructure fabrication using natural synthesis. The investigation into silk optical materials is followed by a final discussion of the control of fluorescence in natural photonic structures. With its distinguished editor and international team of expert contributors, Optical biomimetics is a valuable guide for scientists and engineers in both academia and industry who are already studying biomimetics, and a fascinating introduction for those who wish to move into this interesting new field. Reviews key research in optical biomimetics, focusing on the techniques and approaches used to characterise and mimic naturally-occurring optical effects Discusses optical applications of biomolecules, such as retinylidene and bacteriorhodopsin Explores the control of iridescence in natural photonic structures through the case of butterfly scales

Biomimetic Technologies-Trung Dung Ngo 2015-07-24 Biomimetic engineering takes the principles of biological organisms and copies, mimics or adapts these in the design and development of new materials and technologies. Biomimetic Technologies reviews the key materials and processes involved in this groundbreaking field, supporting theoretical background by outlining a range of applications. Beginning with an overview of the key principles and materials associated with biomimetic technologies in Part One, the book goes on to explore biomimetic sensors in more detail in Part Two, with bio-inspired tactile, hair-based, gas-sensing and sonar systems all reviewed. Biomimetic actuators are then the focus of Part Three, with vision systems, tissue growth and muscles all discussed. Finally, a wide range of applications are investigated in Part Four, where biomimetic technology and artificial intelligence are reviewed for such uses as bio-inspired climbing robots and multi-robot systems, microrobots with CMOS IC neural networks locomotion control, central pattern generators (CPG's) and biologically inspired antenna arrays. Includes a solid overview of modern artificial intelligence as background to the principles of biomimetic engineering Reviews a selection of key bio-inspired materials and sensors, highlighting their current strengths and future potential Features cutting-edge examples of biomimetic technologies employed for a broad range of applications

Bestly Bionics-Jennifer Swanson 2020 Discover how the natural world inspires innovation in science and technology to create the latest and greatest breakthroughs and discoveries in this exciting book. Did you know that scientists have developed a bionic tool shaped like an elephant's trunk that helps lift heavy objects? Or that the needle-like pointed beak of the kingfisher bird encouraged engineers in Japan to change the design of the Shinkansen "bullet trains" to reduce noise? Across multiple fields of study and methods of problem-solving, scientists are turning to biomimicry, or engineering inspired by biology or nature, to make all kinds of cool technological advancements. From robots that protect people and gather information to everyday inventions, like reflectors on the roads and ice-proof coatings for airplanes, to new sources of renewable energy, this book dives into the ways that nature can give us ideas on how to improve our world. Discover more than 40 examples of technology influenced by animals, learn about some of the incredible creatures who have inspired multiple creations, and meet some of the scientists and the stories behind their inventions.

ISITES-ERIN. ROVALO 2019

Biomimicry for Designers-Veronika Kapsali 2016-09-01 The first resource in the emerging field of biomimicry targeted directly at design professionals and students

Biomimetic Nanoengineered Materials for Advanced Drug Delivery-Afeesh Rajan Unnithan 2019-10 Biomimetic Nanoengineered Materials for Advanced Drug Delivery is an indispensable guide for new developments in biomimetic nanoengineering for advanced drug delivery applications. Focusing on the fundamentals of a new type of nanocarriers for drug delivery in the most recent miRNA therapeutics, the book provides readers with detailed knowledge from the basics, to the most recent innovations. Early chapters of the book discuss a range of drug delivery techniques, including nanofibers, biomimetic polymers, 3D bioprinting, nanotechnology and radiofrequency sensitive nanocarriers. Later chapters explore miRNA therapeutics, magnetic nanoparticles, nanogel-based and ROS-mediated drug delivery systems. The book is a vital reference for biomaterials and nanomedicine researchers and clinicians with an interest in advanced drug delivery. Analyzes nanoparticle-plasma protein interactions, making it one of the first books on this topic Includes the latest trends in nanotherapeutic drug delivery Presents comprehensive chapters that cover a specific drug delivery carrier and its mode of operation, stimuli and the target site of action Provides an essential tool for researchers in nanomedicine and nanobiomaterials

Biomimetics in Materials Science-Michael Nosonovsky 2011-12-07 Biomimetics in Materials Science provides a comprehensive theoretical and practical review of biomimetic materials with self-healing, self-lubricating and self-cleaning properties. These three topics are closely related and constitute rapidly developing areas of study. The field of self-healing materials requires a new conceptual understanding of this biomimetic technology, which is in contrast to traditional engineering processes such as wear and fatigue. Biomimetics in Materials Science is the first monograph to be devoted to these materials. A new theoretical framework for these processes is presented based on the concept of multi-scale structure of entropy and non-equilibrium thermodynamics, together with a detailed review of the available technology. The latter includes experimental, modeling, and simulation results obtained on self-healing/lubricating/cleaning materials since their emergence in the past decade.