

# Silicon Earth

John Cressler, Editor

REVIEWED BY MOHAMMAD MOJARRADI AND BENJAMIN BLALOCK

typically requires an undergraduate-level college course in electrical engineering or reading a classical text on the subject, but that does not provide you with the global impact of silicon.

*Silicon Earth* provides a concise, easy to follow, step-by-step discussion of the evolutionary history of silicon-based electronics, microelectromechanical structures (MEMS), and nanotechnology, as well as their impact on our lives. History texts typically lack technical depth, particularly that which is warranted for understanding silicon-based technology. This book, however, will provide you with a unique perspective that is both

JOHN CRESSLER'S *SILICON EARTH* will take you through a historical voyage to the modern wonders of electronics and nanotechnology. Silicon is the technological foundation of our multidimensional information highway. The frontiers of this silicon-based universe are defined by ever-shrinking transistors, increasingly complex computational systems, continuously growing numbers of micromachined devices, and rapidly evolving nanotechnology systems. Gadgets and widgets that comprise these frontiers affect our daily life and revolutionize our culture. Like it or not, our personal universe is now defined by silicon, which is rapidly becoming the dominant factor that influences every aspect of our lifestyle. Coping with this fast-changing lifestyle demands a historical understanding of the 50-year evolution of silicon, together with the fundamental principles that drive its growing expansion into our lives. *Silicon Earth* is designed to provide readers with this historical understanding.

If you are a parent, you may appreciate this book more, particularly as your child enters those curious teenage years. For example, Blalock's teenage son recently received his cell phone and enjoys swapping text messages with friends. Mojarradi's teenage son is a self-proclaimed "Teslacian" (member of an informal self-organized group dedicated to repeating Nikola Tesla's experiments). He enjoys building solid-state Tesla coils that can create spectacular lightning discharges accompanied by sounds similar to "Mario Bros. tunes." He also builds his own computers with high-resolution graphics and Internet accelerators for his next high-tech video game and participates in the robotics contests at his high school. What happened to "fixing the

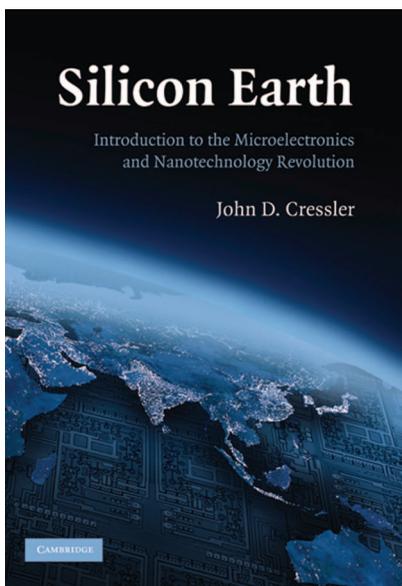
old man's '67 Chevy?" Only Mr. Silicon, the affectionate name Cressler uses for silicon technology, has the power to bring about fundamental and permanent changes in our lifestyles. Consequently, it is now more appealing to our teenagers to build computers, robots, and Tesla coils instead of rebuilding old cars. It is a brave new era spawned by silicon.

Given the increasing daily usage of high-tech instruments and gadgets, some first-hand knowledge of Mr. Silicon is warranted. As a bare minimum, this may help to better understand the behavior of today's teenagers. Better yet, you may be able to answer their fundamental technical questions. In addition, if you are a nonelectrical engineering professional, scholar, or college student, an understanding of the silicon world only adds to your understanding of the fundamental operation of modern tools and their impact on your surroundings. Studying the solid-state physics that govern the interaction of charge carriers in silicon

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technically and historically balanced, without the prerequisite of an electrical engineering degree.

In the absence of a balanced perspective on this subject, if you are a parent, your child will drive you crazy with questions that are both profound and entertaining: What if the transistor was not invented? What if all the transistors stopped working today? What is nanotechnology anyway, and why should I care? Who are those Maxwell and Ohm fellows? We can personally testify as electrical engineering professionals that our highly technical responses to such questions are only a source of disappointment and discouragement to them. Just as when we were rebuilding our dad's old Chevy, our teenagers are looking for some pioneering recognition and thrilling story of motivation not a technical briefing. Unfortunately, our dry technical answers generate a lack of interest on our sons' part and an increasing interest in other



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distractions (such as video games). In a moment of reflection, we jointly decided to conduct an experiment, asking our teenagers to read *Silicon Earth*.

The topic coverage in this book is quite remarkable, including upcoming implantable nanoprosthesis that can potentially extend our lifespan and provide us with bionic super sense of hearing, vision, and smell to new highly advanced cell phones and personal digital assistants (PDAs) that enable us to surf the net and reach out to our friends and family all over the world. Cressler's treatment of these incredible topics helps even the casual reader to understand the world of silicon. Reducing silicon, and the wide spectrum of technical and historical disciplines and topics it encompasses, into an easily readable and exciting text suitable for a broad nontechnical audience is a monumental challenge. The

Silicon is the technological foundation of our multidimensional, information highway.

ability to express these topics in simple language is a skill gifted to only a few talented writers. Demonstrated in *Silicon Earth*, Cressler has this gift. In *Silicon Earth*, Cressler reflects his inner thoughts as a world-class electrical engineering scholar, philosopher, and student of modern history. This book is a comprehensive yet thrilling and invigorating simple-to-read text that is well on its way to becoming a classic.

The book reduces highly abstract, technical, and mathematical topics foundational to the frontiers of silicon into a thrilling tale of pioneering history with very simple mathematics in an easy-to-understand and readable style. Graphically decorated with pictures and stories from the greatest science fiction movies (e.g., *Terminator* and *Fantastic Voyage*), the book helps the reader visualize the fundamental principles of electrical engineering and nanotechnology. To further stimulate and entertain the reader, the book is adorned with interesting anecdotes: "Greek Trivia," "Historical Anecdotes," "Deep Thoughts," and "Life Digressions."

The book provides readers with many fundamental answers. These answers cover diverse topics from "when and how" transistors were invented and "why they work," to discussion of "global position



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sensors,” and how sophisticated computers systems are fabricated. However, the most stimulating part of the book is the last two chapters where the reader experiences the real science of nanotechnology, otherwise considered science fiction only 20 years ago. Cressler aptly starts the chapter citing the 1966 science fiction movie *Fantastic Voyage*.

Finally, *Silicon Earth* is strongly recommended for technical “oldies” that may have lost sight of the history of silicon and inquisitive youth that yearn to develop a profound understanding of factors affecting their lifestyle. And yes, back to our teenagers reading *Silicon Earth*, each has presented different perspectives. Blalock’s teenage son, who enjoys swapping text messages with friends, gravitated to the “Widget Deconstruction #1: Cell Phone” chapter in *Silicon Earth*. From his reading, he found it interesting that Alexander Graham Bell beat out Elisa Gray to become the inventor of the telephone and gained an appreciation for the technological evolution of the telephone to the amazing cell phone. Thanks to this chapter, he gained an understanding of cell phones’ dependence on cell towers to communicate, the range limitations of cell towers, the communication channel-selection process, and how cell towers transfer these channels back and forth. In addition, he read about the distinction between analog cell phones and digital second-generation (2G) and third-generation (3G) phones and gained an appreciation for the complexity of 3G phones. *Silicon Earth* dissects the 3G phone into subsystems (such as the antenna, display, transducers, applications, radio, memory, ADCs, and power system)

and illustrates their dependence on silicon-based integrated circuits that enable these high-tech marvels, all while entertaining even young readers. That is a great accomplishment.

Reading this book renewed the interest of Mojradi’s teenage son in electronics. He decided to go build a new Tesla coil

and asked his father to help him with the new silicon microcontroller-based audio synthesizer he needed for this purpose. He recommended *Silicon Earth* as a “cool book” to his fellow Internet friends as he posted pictures of his new Tesla coil on the Web.

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