

Research Article

Zhanhan Hu*, Danaysa Macías Hernández, and Silega Nemuri Martinez

Analysis of radiation effects of semiconductor devices based on numerical simulation Fermi–Dirac

<https://doi.org/10.1515/nleeng-2022-0020>

received October 26, 2021; accepted February 23, 2022

Abstract: To study the radiation effect of Fermi–Dirac (F–D) semiconductor devices based on numerical simulation, two methods are used. One is based on the combination of F–D statistical method and computer simulation. The method discusses the influence of temperature and light energy on the carrier number by starting from an intrinsic silicon semiconductor and carries out computer simulation on the carrier number in intrinsic silicon semiconductor. TID Sim, a three-dimensional parallel solver for ionizing radiation effects of semiconductor devices, is developed. The ionization radiation damage of typical metal oxide semiconductor (MOS) FET NMOS and bipolar transistor GLPNP is simulated. It was proved that the variation trend was close to a straight line in the temperature range (278–358 K) studied in this article. The results are consistent with those of the statistical distribution of semiconductor carriers. This method is suitable for calculating the number of semiconductor carriers, and it is an effective method to study the problems related to carrier distribution.

Keywords: F–D statistical method, semiconductor, radiation effect

1 Introduction

Metal oxide semiconductor (MOS) will degrade its performance parameters when exposed to high-energy ionizing radiation; the typical phenomena are threshold voltage drift and off-state leakage current increase. This is a long-term effect; that is, the phenomenon of effect cannot be eliminated after the device is powered off [1]. The cause of the long-term radiation effect of MOS devices is the formation of trapped charges that are difficult to move in the gate oxide or isolation oxide; this makes the channel surface form an inversion or a leakage path between the source and the drain when no bias is applied. Therefore, the generation of trapped charges, the transport, and final distribution have an important influence on the long-term effect of the device [2]. The Monte Carlo method and the coupling method of the finite volume method are used to simulate the long-term radiation effect caused by the oxide trap charge in the MOS tube. Using the Monte Carlo method to track the random transport process of incident particles, the ionization energy deposition distribution can be obtained, and this distribution is coupled to the drift-diffusion model equation as a source term [3]. To discretize the governing equation using the finite volume method and solve the Poisson equation in gate oxide and silicon together, the carrier continuity equation and the trapping rate equation of gate oxide, in this way, the threshold voltage drift and off-state leakage current of a typical MOS tube after being irradiated can be calculated. Gamma irradiation is a key environmental factor that causes the performance degradation and even permanent failure of satellite electronic systems. There are two basic effects of semiconductor device ionization radiation damage: Total ionizing dose effect, that is, the damage of the device, increases cumulatively with the increase in the total radiation dose, and the enhanced low dose rate effect (enhanced low dose rate sensitivity [ELDRS] effect) [3]. That is, under the condition of a fixed total radiation dose, the damage to

* Corresponding author: Zhanhan Hu, School of computing, North China Institute of Aerospace Engineering, Langfang, Hebei, 065000, China, e-mail: ZhanhanHu1@163.com

Danaysa Macías Hernández: Universidad de Matanzas “Camillo Cienfuegos”, Matanzas, Cuba, e-mail: danaysa.macias@umcc.cu

Silega Nemuri Martinez: Institute of Computer Technology and Information Security, Southern Federal University, Rostov-on-Don, Russia, e-mail: silega@sfsu.ru

Numerical Analysis For Semiconductor Devices

John J. H. Miller



Numerical Analysis For Semiconductor Devices:

Numerical Analysis for Semiconductor Devices Mamoru Kurata, 1982 **Numerical Analysis of Semiconductor Devices** Pascal Sweil Lin Chen, 1982 Numerical Analysis of Semiconductor Devices John Gary Shaw, 1983 **Analysis and Simulation of Semiconductor Devices** S. Selberherr, 1984-07 The invention of semiconductor devices is a fairly recent one considering classical time scales in human life The bipolar transistor was announced in 1947 and the MOS transistor in a practically usable manner was demonstrated in 1960 From these beginnings the semiconductor device field has grown rapidly The first integrated circuits which contained just a few devices became commercially available in the early 1960s Immediately thereafter an evolution has taken place so that today less than 25 years later the manufacture of integrated circuits with over 400 000 devices per single chip is possible Coincident with the growth in semiconductor device development the literature concerning semiconductor device and technology issues has literally exploded In the last decade about 50 000 papers have been published on these subjects The advent of so called Very Large Scale Integration VLSI has certainly revealed the need for a better understanding of basic device behavior The miniaturization of the single transistor which is the major prerequisite for VLSI nearly led to a breakdown of the classical models of semiconductor devices

Numerical Analysis of Semiconductor Devices and Integrated Circuits B. T. Browne, John James Henry Miller, 1981 **An Introduction to the Numerical Analysis of Semiconductor Devices and Integrated Circuits** John James Henry Miller, 1981 Companion volume to NASECODE II Conference proceedings Numerical Analysis of Semiconductor Devices and Integrated Circuits J. J. H. Miller, 1985 **Numerical analysis of semiconductor devices. Proceedings of the NASECODE Conference ; 8** , 1992 Numerical analysis of semiconductor devices. Proceedings of the NASECODE Conference ; 5 , 1987 **The Stationary Semiconductor Device Equations** P.A. Markowich, 2013-03-09 In the last two decades semiconductor device simulation has become a research area which thrives on a cooperation of physicists electrical engineers and mathematicians In this book the static semiconductor device problem is presented and analysed from an applied mathematician's point of view I shall derive the device equations as obtained for the first time by Van Roosbroeck in 1950 from physical principles present a mathematical analysis discuss their numerical solution by discretisation techniques and report on selected device simulation runs To me personally the most fascinating aspect of mathematical device analysis is that an interplay of abstract mathematics perturbation theory numerical analysis and device physics is prompting the design and development of new technology I very much hope to convey to the reader the importance of applied mathematics for technological progress Each chapter of this book is designed to be as self-contained as possible however the mathematical analysis of the device problem requires tools which cannot be presented completely here Those readers who are not interested in the mathematical methodology and rigor can extract the desired information by simply ignoring details and proofs of theorems Also at the beginning of each chapter I refer to textbooks which introduce the interested reader to the

required mathematical concepts *Numerical Analysis of Semiconductor Devices* John J. H. Miller, 1981 **Numerical Analysis of Semiconductor Devices** NASECODE Conference (1, 1979, Dublin), 1981 **Numerical analysis of semiconductor devices. Proceedings of the NASECODE Conference ; 7**, 1991 *Numerical analysis of semiconductor devices. Proceedings of the NASECODE Conference ; 9*, 1993 **Noise in Semiconductor Devices** Fabrizio Bonani, Giovanni Ghione, 2013-03-09

The design and optimization of electronic systems often requires appraisal of the electrical noise generated by active devices and at a technological level the ability to properly design active elements in order to minimize when possible their noise. Examples of critical applications are of course receiver front ends in RF and optoelectronic transmission systems but also front end stages in sensors and in a completely different context nonlinear circuits such as oscillators, mixers and frequency multipliers. The rapid development of silicon RF applications has recently fostered the interest toward low noise silicon devices for the lower microwave band such as low noise MOS transistors. At the same time the RF and microwave ranges are becoming increasingly important in fast optical communication systems. Thus high frequency noise modeling and simulation of both silicon and compound semiconductor based bipolar and field effect transistors can be considered as an important and timely topic. This does not exclude of course low frequency noise which is relevant also in the RF and microwave ranges whenever it is up converted within a nonlinear system either autonomous as an oscillator or non autonomous as a mixer or frequency multiplier. The aim of the present book is to provide a thorough introduction to the physics based numerical modeling of semiconductor devices operating both in small signal and in large signal conditions. In the latter instance only the non autonomous case was considered and thus the present treatment does not directly extend to oscillators.

NASECODE, 1985 *Nasecode IV* John James Henry Miller, 1985 **Analysis and Simulation of Semiconductor Devices** S. Selberherr, 2012-12-06

The invention of semiconductor devices is a fairly recent one considering classical time scales in human life. The bipolar transistor was announced in 1947 and the MOS transistor in a practically usable manner was demonstrated in 1960. From these beginnings the semiconductor device field has grown rapidly. The first integrated circuits which contained just a few devices became commercially available in the early 1960s. Immediately thereafter an evolution has taken place so that today less than 25 years later the manufacture of integrated circuits with over 400 000 devices per single chip is possible. Coincident with the growth in semiconductor device development the literature concerning semiconductor device and technology issues has literally exploded. In the last decade about 50 000 papers have been published on these subjects. The advent of so called Very Large Scale Integration VLSI has certainly revealed the need for a better understanding of basic device behavior. The miniaturization of the single transistor which is the major prerequisite for VLSI nearly led to a breakdown of the classical models of semiconductor devices.

Numerical Analysis of Semiconductor Devices John Gary Shaw, 1983 **Nasecode IX** John J. H. Miller, 1993-04

Numerical Analysis For Semiconductor Devices Book Review: Unveiling the Magic of Language

In an electronic era where connections and knowledge reign supreme, the enchanting power of language has become more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is truly remarkable. This extraordinary book, aptly titled "**Numerical Analysis For Semiconductor Devices**," written by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we will delve to the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

https://pinsupreme.com/public/Resources/HomePages/Protestants_Catholics_And_Jews_In_Germany_18001914.pdf

Table of Contents Numerical Analysis For Semiconductor Devices

1. Understanding the eBook Numerical Analysis For Semiconductor Devices
 - The Rise of Digital Reading Numerical Analysis For Semiconductor Devices
 - Advantages of eBooks Over Traditional Books
2. Identifying Numerical Analysis For Semiconductor Devices
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Numerical Analysis For Semiconductor Devices
 - User-Friendly Interface
4. Exploring eBook Recommendations from Numerical Analysis For Semiconductor Devices
 - Personalized Recommendations
 - Numerical Analysis For Semiconductor Devices User Reviews and Ratings
 - Numerical Analysis For Semiconductor Devices and Bestseller Lists

5. Accessing Numerical Analysis For Semiconductor Devices Free and Paid eBooks
 - Numerical Analysis For Semiconductor Devices Public Domain eBooks
 - Numerical Analysis For Semiconductor Devices eBook Subscription Services
 - Numerical Analysis For Semiconductor Devices Budget-Friendly Options
6. Navigating Numerical Analysis For Semiconductor Devices eBook Formats
 - ePub, PDF, MOBI, and More
 - Numerical Analysis For Semiconductor Devices Compatibility with Devices
 - Numerical Analysis For Semiconductor Devices Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Numerical Analysis For Semiconductor Devices
 - Highlighting and Note-Taking Numerical Analysis For Semiconductor Devices
 - Interactive Elements Numerical Analysis For Semiconductor Devices
8. Staying Engaged with Numerical Analysis For Semiconductor Devices
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Numerical Analysis For Semiconductor Devices
9. Balancing eBooks and Physical Books Numerical Analysis For Semiconductor Devices
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Numerical Analysis For Semiconductor Devices
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Numerical Analysis For Semiconductor Devices
 - Setting Reading Goals Numerical Analysis For Semiconductor Devices
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Numerical Analysis For Semiconductor Devices
 - Fact-Checking eBook Content of Numerical Analysis For Semiconductor Devices
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

Numerical Analysis For Semiconductor Devices Introduction

Free PDF Books and Manuals for Download: Unlocking Knowledge at Your Fingertips In today's fast-paced digital age, obtaining valuable knowledge has become easier than ever. Thanks to the internet, a vast array of books and manuals are now available for free download in PDF format. Whether you are a student, professional, or simply an avid reader, this treasure trove of downloadable resources offers a wealth of information, conveniently accessible anytime, anywhere. The advent of online libraries and platforms dedicated to sharing knowledge has revolutionized the way we consume information. No longer confined to physical libraries or bookstores, readers can now access an extensive collection of digital books and manuals with just a few clicks. These resources, available in PDF, Microsoft Word, and PowerPoint formats, cater to a wide range of interests, including literature, technology, science, history, and much more. One notable platform where you can explore and download free Numerical Analysis For Semiconductor Devices PDF books and manuals is the internet's largest free library. Hosted online, this catalog compiles a vast assortment of documents, making it a veritable goldmine of knowledge. With its easy-to-use website interface and customizable PDF generator, this platform offers a user-friendly experience, allowing individuals to effortlessly navigate and access the information they seek. The availability of free PDF books and manuals on this platform demonstrates its commitment to democratizing education and empowering individuals with the tools needed to succeed in their chosen fields. It allows anyone, regardless of their background or financial limitations, to expand their horizons and gain insights from experts in various disciplines. One of the most significant advantages of downloading PDF books and manuals lies in their portability. Unlike physical copies, digital books can be stored and carried on a single device, such as a tablet or smartphone, saving valuable space and weight. This convenience makes it possible for readers to have their entire library at their fingertips, whether they are commuting, traveling, or simply enjoying a lazy afternoon at home. Additionally, digital files are easily searchable, enabling readers to locate specific information within seconds. With a few keystrokes, users can search for keywords, topics, or phrases, making research and finding relevant information a breeze. This efficiency saves time and effort, streamlining the learning process and allowing individuals to focus on extracting the information they need. Furthermore, the availability of free PDF books and manuals fosters a culture of continuous learning. By removing financial barriers, more people can access educational resources and

pursue lifelong learning, contributing to personal growth and professional development. This democratization of knowledge promotes intellectual curiosity and empowers individuals to become lifelong learners, promoting progress and innovation in various fields. It is worth noting that while accessing free Numerical Analysis For Semiconductor Devices PDF books and manuals is convenient and cost-effective, it is vital to respect copyright laws and intellectual property rights. Platforms offering free downloads often operate within legal boundaries, ensuring that the materials they provide are either in the public domain or authorized for distribution. By adhering to copyright laws, users can enjoy the benefits of free access to knowledge while supporting the authors and publishers who make these resources available. In conclusion, the availability of Numerical Analysis For Semiconductor Devices free PDF books and manuals for download has revolutionized the way we access and consume knowledge. With just a few clicks, individuals can explore a vast collection of resources across different disciplines, all free of charge. This accessibility empowers individuals to become lifelong learners, contributing to personal growth, professional development, and the advancement of society as a whole. So why not unlock a world of knowledge today? Start exploring the vast sea of free PDF books and manuals waiting to be discovered right at your fingertips.

FAQs About Numerical Analysis For Semiconductor Devices Books

How do I know which eBook platform is the best for me? Finding the best eBook platform depends on your reading preferences and device compatibility. Research different platforms, read user reviews, and explore their features before making a choice. Are free eBooks of good quality? Yes, many reputable platforms offer high-quality free eBooks, including classics and public domain works. However, make sure to verify the source to ensure the eBook credibility. Can I read eBooks without an eReader? Absolutely! Most eBook platforms offer webbased readers or mobile apps that allow you to read eBooks on your computer, tablet, or smartphone. How do I avoid digital eye strain while reading eBooks? To prevent digital eye strain, take regular breaks, adjust the font size and background color, and ensure proper lighting while reading eBooks. What the advantage of interactive eBooks? Interactive eBooks incorporate multimedia elements, quizzes, and activities, enhancing the reader engagement and providing a more immersive learning experience. Numerical Analysis For Semiconductor Devices is one of the best book in our library for free trial. We provide copy of Numerical Analysis For Semiconductor Devices in digital format, so the resources that you find are reliable. There are also many Ebooks of related with Numerical Analysis For Semiconductor Devices. Where to download Numerical Analysis For Semiconductor Devices online for free? Are you looking for Numerical Analysis For Semiconductor Devices PDF? This is definitely going to save you time and cash in something you should think about. If you trying to find then search around for online. Without a doubt there are numerous these available and many of them have the freedom. However without doubt you receive whatever you

purchase. An alternate way to get ideas is always to check another Numerical Analysis For Semiconductor Devices. This method for see exactly what may be included and adopt these ideas to your book. This site will almost certainly help you save time and effort, money and stress. If you are looking for free books then you really should consider finding to assist you try this. Several of Numerical Analysis For Semiconductor Devices are for sale to free while some are payable. If you arent sure if the books you would like to download works with for usage along with your computer, it is possible to download free trials. The free guides make it easy for someone to free access online library for download books to your device. You can get free download on free trial for lots of books categories. Our library is the biggest of these that have literally hundreds of thousands of different products categories represented. You will also see that there are specific sites catered to different product types or categories, brands or niches related with Numerical Analysis For Semiconductor Devices. So depending on what exactly you are searching, you will be able to choose e books to suit your own need. Need to access completely for Campbell Biology Seventh Edition book? Access Ebook without any digging. And by having access to our ebook online or by storing it on your computer, you have convenient answers with Numerical Analysis For Semiconductor Devices To get started finding Numerical Analysis For Semiconductor Devices, you are right to find our website which has a comprehensive collection of books online. Our library is the biggest of these that have literally hundreds of thousands of different products represented. You will also see that there are specific sites catered to different categories or niches related with Numerical Analysis For Semiconductor Devices So depending on what exactly you are searching, you will be able to choose ebook to suit your own need. Thank you for reading Numerical Analysis For Semiconductor Devices. Maybe you have knowledge that, people have search numerous times for their favorite readings like this Numerical Analysis For Semiconductor Devices, but end up in harmful downloads. Rather than reading a good book with a cup of coffee in the afternoon, instead they juggled with some harmful bugs inside their laptop. Numerical Analysis For Semiconductor Devices is available in our book collection an online access to it is set as public so you can download it instantly. Our digital library spans in multiple locations, allowing you to get the most less latency time to download any of our books like this one. Merely said, Numerical Analysis For Semiconductor Devices is universally compatible with any devices to read.

Find Numerical Analysis For Semiconductor Devices :

[protestants catholics and jews in germany 18001914](#)

psychic being the soul in evolution

psychiatric treatment of sexual offenders

~~prospector cowhand sodbuster~~

protecting human rights in infoage

protons and muons in materials science

psalms for today music edition

protection against neutron radiation report series no 38

prostate cancer sourcebook basic consumer health information about prostate cancerhc2001

providing a palliative care service towards an evidence base

prosas profanos rubn daro

protestantism and the rise of capitalism

prudence of plymouth plantation

provincial types in american fiction

psychiatry for the developing world

Numerical Analysis For Semiconductor Devices :

Quantitative Problem Solving Methods in the Airline Industry by C Barnhart · Cited by 62 — There are several common themes in current airline Operations Research efforts. First is a growing focus on the customer in terms of: 1) what they want; 2) what ... Quantitative problem solving methods in the airline industry Quantitative Problem Solving Methods in the Airline Industry: A Modeling Methodology Handbook . New York: Springer, 2012. Web.. <https://lccn.loc.gov/2011940035>. Quantitative Problem Solving Methods in the Airline Industry This book reviews Operations Research theory, applications and practice in seven major areas of airline planning and operations. In each area, a team of ... Quantitative problem solving methods in the airline industry Quantitative problem solving methods in the airline industry: A modeling methodology handbook by Cynthia Barnhart and Barry Smith ... The full article is ... Quantitative Problem Solving Methods in the Airline Industry by C Barnhart · 2012 · Cited by 62 — By Cynthia Barnhart and Barry Smith; Quantitative Problem Solving Methods in the Airline Industry. Quantitative Problem Solving Methods in the Airline Industry A ... Quantitative Problem Solving Methods in the Airline Industry A Model. This book reviews Operations Research theory, applications and practice in seven major ... Quantitative problem solving methods in the airline industry Quantitative problem solving methods in the airline industry a modeling methodology handbook / ; Airlines > Management > Simulation methods. Operations research. Quantitative Problem Solving Methods in... book by Cynthia ... This book reviews Operations Research theory, applications and practice in seven major areas of airline planning and operations. Free ebook Quantitative problem solving methods in the ... Aug 16, 2023 — We come up with the money for quantitative problem solving methods in the airline industry a modeling methodology handbook international ... Quantitative Problem Solving Methods in the Airline ... Jul 15, 2020 — Quantitative Problem Solving Methods in the Airline Industry: A Modeling Methodology Handbook 1st Edition is written by Cynthia

Barnhart; Barry ... Reading free Elizayutani deliver me .pdf - resp.app Jul 5, 2023 — Thank you very much for downloading elizayutani deliver me. As you may know, people have look hundreds times for their favorite readings ... Reading free Elizayutani deliver me (Download Only) \ resp.app Jun 24, 2023 — Recognizing the exaggeration ways to get this books elizayutani deliver me is additionally useful. You have remained in right site to start. Deliver Me (This Is My Exodus) - YouTube Deliver Me (This Is My Exodus) - YouTube Get Real Like Jesus Would Own Gun Vote Republican ... Get Real Like Jesus Would Own Gun Vote Republican Bumper Sticker - [11" x 3"] - EF-STK-B-10297 · Item details · Delivery and return policies · Meet your sellers. Get Real Like Jesus Would Own Gun Vote Republican ... Get Real Like Jesus Would Own Gun Vote Republican Bumper Sticker - [11" x 3"] - EF-STK-B-10297 · Item details · Shipping and return policies · Meet your sellers. Le'Andria Johnson - Deliver Me (NEW) 2022 - YouTube Deliver Me (This Is My Exodus) - YouTube Virgin Sacrifice "So Stiles needs to get de-virginized, stat." Or, episodic crack!porn, to be delivered here weekly. ... You'll never be bored again. Solutions Manual to accompany Principles of Corporate ... Solutions Manual to accompany Principles of Corporate Finance. 7th Edition. ISBN-13: 978-0072468007, ISBN ... Fundamentals of Corporate Finance - 7th Edition - Quizlet Our resource for Fundamentals of Corporate Finance includes answers to chapter exercises, as well as detailed information to walk you through the process step ... Fundamentals of Corporate Finance 7th Edition Brealey ... Fundamentals of Corporate Finance 7th Edition Brealey Solutions Manual - Free download as PDF File (.pdf), Text File (.txt) or read online for free. Richard Brealey Solutions | Chegg.com Solutions Manual to accompany Principles of Corporate Finance 7th Edition 0 Problems solved, Richard A Brealey, Richard A. Brealey, Stewart C. Fundamentals Of Corporate Finance With Connect Plus 7th ... Access Fundamentals of Corporate Finance with Connect Plus 7th Edition solutions now. Our solutions are written by Chegg experts so you can be assured of ... Principles of corporate finance 7th edition solutions Principles of corporate finance 7th edition solutions manual Principles of from BUS5 162 at San Jose State University. Solutions manual to accompany principles of corporate ... Solutions manual to accompany principles of corporate finance. Authors: Richard A. Brealey, Stewart C. Myers, Bruce Swensen. Front cover image for Solutions ... Corporate finance brealey myers marcus 7th edition so corporate finance brealey myers marcus 7th edition so Solution manual for from ECON 358 at University of Nevada, Las Vegas. [AVAILABLE] Fundamentals of Corporate Finance by ... [AVAILABLE] Fundamentals of Corporate Finance by Richard A. Brealey (7th Canadian Edition) TEXTBOOK + TEST BANK + SOLUTIONS MANUAL. Fundamentals of Corporate Finance, 7ce Brealey Oct 17, 2023 — Fundamentals of Corporate Finance, 7th Canadian Edition, By Brealey, Myers, Marcus, Mitra, Gajurel (Solutions Manual with Test Bank). \$ 50.98 ...