

The Gunn-Hilsum Effect

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The Gunn Hilsum Effect

Karl W. Böer



The Gunn Hilsum Effect:

The Gunn-Hilsum Effect Melvin Shaw, 2012-12-02 The Gunn Hilsum Effect covers the physical principles controlling the operation of transferred electron devices. These devices have been proven quite useful in the generation, amplification, and processing of microwave signals well into tens of gigahertz range. Organized into seven chapters, the book focuses on the analytical and numerical approaches of the two vital aspects of device behavior for a given bulk semiconductor boundary conditions or contacts and the local circuit environment. The opening chapter of this book discusses the negative differential mobility (NDM) characteristics for a range of electric fields in the velocity-field relation of specific semiconductors and the response of such a sample to a charge fluctuation leading to the growth of stationary and/or traveling high electric field domains. The next two chapters describe how the boundary conditions and the circuit control the manifestation of current instabilities in such systems and how this control can be understood in a simple manner. Chapters 4 and 5 discuss the numerical and experimental investigations of comparatively long bulk samples with an emphasis on the essential NDM semiconductor n-GaAs. These chapters also examine the production of different current-voltage relationships and instabilities by cathode contacts and the control of the oscillatory characteristics of an electrically unstable sample by different circuit conditions. Chapter 6 presents both time-independent and time-dependent computations with the latter focusing on the small-signal impedance and stability aspects. The last chapter of this book addresses the construction and evaluation of typical short devices, describes how their oscillatory characteristics compare with the long samples studied in the first six chapters, and discusses the use of short devices as amplifiers. This book is an ideal source for device engineers and designers wishing to apply transferred electron devices in creative ways. *The Gunn-Hilsum Effect* Shaw M.P., **GaAs Devices and**

Circuits Michael S. Shur, 2013-11-21 GaAs devices and integrated circuits have emerged as leading contenders for ultra-high-speed applications. This book is intended to be a reference for a rapidly growing GaAs community of researchers and graduate students. It was written over several years and parts of it were used for courses on GaAs devices and integrated circuits and on heterojunction GaAs devices developed and taught at the University of Minnesota. Many people helped me in writing this book. I would like to express my deep gratitude to Professor Lester Eastman of Cornell University whose ideas and thoughts inspired me and helped to determine the direction of my research work for many years. I also benefited from numerous discussions with his students and associates and from the very atmosphere of the pursuit of excellence which exists in his group. I would like to thank my former and present co-workers and colleagues Drs. Levinstein and Gelmont of the A.F. Ioffe Institute of Physics and Technology, Professor Melvin Shaw of Wayne State University, Dr. Kastalsky of Bell Communications, Professor Gary Robinson of Colorado State University, Professor Tony Valois, and Dr. Tim Drummond of Sandia Labs for their contributions to our joint research and for valuable discussions. My special thanks to Professor Morko for his help, his ideas, and the example set by his pioneering work. Since 1978 I have been working with engineers from Honeywell Inc. Drs.

The Physics of Instabilities in Solid State Electron Devices Harold L. Grubin, V.V. Mitin, E. Schöll, M.P. Shaw, 2013-11-11

The past three decades have been a period where useful current and voltage instabilities in solids have progressed from exciting research problems to a wide variety of commercially available devices. Materials and electronics research has led to devices such as the tunnel Esaki diode, transferred electron Gunn diode, avalanche diodes, real space transfer devices and the like. These structures have proven to be very important in the generation, amplification, switching and processing of microwave signals up to frequencies exceeding 100 GHz. In this treatise we focus on a detailed theoretical understanding of devices of the kind that can be made unstable against circuit oscillations, large amplitude switching events and in some cases internal rearrangement of the electric field or current density distribution. The book is aimed at the semiconductor device physicist, engineer and graduate student. A knowledge of solid state physics on an elementary or introductory level is assumed. Furthermore, we have geared the book to device engineers and physicists desirous of obtaining an understanding substantially deeper than that associated with a small signal equivalent circuit approach. We focus on both analytical and numerical treatment of specific device problems concerning ourselves with the mechanism that determines the constitutive relation governing the device, the boundary conditions, contact effects and the effect of the local circuit environment.

Handbook of Terahertz Technology Neil Sellers, 2018-01-21. Terahertz radiation, also known as submillimeter radiation, terahertz waves, tremendously high frequency THF, T rays, T waves, T light, T lux or THz, consists of electromagnetic waves within the ITU designated band of frequencies from 0.3 to 3 terahertz. Wavelengths of radiation in the terahertz band correspondingly range from 1 mm to 0.1 mm. Because terahertz radiation begins at a wavelength of one millimeter and proceeds into shorter wavelengths, it is sometimes known as the submillimeter band, and its radiation as submillimeter waves, especially in astronomy. The book presents information about Terahertz science, Terahertz photodetectors and Terahertz Lasers. A special emphasis is given to room temperature operation of long wavelength photodetectors based on novel quantum dots. Moreover, a complete analysis of systems based on Quantum Cascade structures to detect far infrared wavelengths is provided. Finally, the book presents Terahertz laser principles, considering multi-color lasers in this range of wavelengths. It is written as a background for graduate students in the Optics field.

Physics of Semiconductor Devices Simon M. Sze, Yiming Li, Kwok K. Ng, 2021-03-03. The new edition of the most detailed and comprehensive single volume reference on major semiconductor devices. The Fourth Edition of *Physics of Semiconductor Devices* remains the standard reference work on the fundamental physics and operational characteristics of all major bipolar, unipolar, special microwave and optoelectronic devices. This fully updated and expanded edition includes approximately 1,000 references to original research papers and review articles, more than 650 high quality technical illustrations and over two dozen tables of material parameters. Divided into five parts, the text first provides a summary of semiconductor properties covering energy band, carrier concentration and transport properties. The second part surveys the basic building blocks of semiconductor devices.

including p n junctions metal semiconductor contacts and metal insulator semiconductor MIS capacitors Part III examines bipolar transistors MOSFETs MOS field effect transistors and other field effect transistors such as JFETs junction field effect transistors and MESFETs metal semiconductor field effect transistors Part IV focuses on negative resistance and power devices The book concludes with coverage of photonic devices and sensors including light emitting diodes LEDs solar cells and various photodetectors and semiconductor sensors This classic volume the standard textbook and reference in the field of semiconductor devices Provides the practical foundation necessary for understanding the devices currently in use and evaluating the performance and limitations of future devices Offers completely updated and revised information that reflects advances in device concepts performance and application Features discussions of topics of contemporary interest such as applications of photonic devices that convert optical energy to electric energy Includes numerous problem sets real world examples tables figures and illustrations several useful appendices and a detailed solutions manual for Instructor s only Explores new work on leading edge technologies such as MODFETs resonant tunneling diodes quantum cascade lasers single electron transistors real space transfer devices and MOS controlled thyristors *Physics of Semiconductor Devices Fourth Edition* is an indispensable resource for design engineers research scientists industrial and electronics engineering managers and graduate students in the field

Selected Works of Professor Herbert Kroemer C. K. Maiti, 2008 Information technology has changed our society radically Just as the integrated circuits have been the prime mover for electronics high speed transistors and semiconductor lasers based on heterostructures are now playing the same role in modern telecommunications Professor Kroemer s conceptual work on heterostructures began in the early 1950s as he was looking for a way to improve transistor speed and performance In the 1960s he applied the same principles to the development of lasers and light emitting diodes showing that they could achieve continuous operation at room temperature OCo something thought impossible at that time His deep fundamental scientific work has had a profound effect on technology and society transforming and improving our lives This reprint collection brings together Professor Kroemer s most important papers presenting a comprehensive perspective of the field It covers topics ranging from substrate materials electronic properties process technology and devices to circuits and applications This reprint collection will help the reader identify the key stages in the development of heterostructure devices and lasers from early research through to its integration in current manufacturing Devoted to R D engineers and scientists who are actively involved in extending the nano and microelectronics roadmap mainly via heterostructure engineering this volume may also serve as a reference for postgraduate and research students

Advances in Electronics and Electron Physics ,1980-09-01 Advances in Electronics and Electron Physics

Electro-Optical Effects to Visualize Field and Current Distributions in Semiconductors Karl W. Böer, 2010-02-02 This book describes the basic principles that relate to field and current inhomogeneities in semiconductors and their kinetics that occur in the regime of negative differential conductances of semiconductors

Explaining Jesus Benjamin

Bennett-Carpenter, 2018-11-27 How exactly does one explain Jesus That is the central question of this book But the task of explaining Jesus is complicated For many nonbelievers skeptics or practitioners of non Jesus based religions or spiritualities it can be very strange to refer to a particular man who lived in the first century CE as someone who is still living Even for some believers this idea can be a difficult thing to understand even given the teachings of their faith Thus whether believer or nonbeliever or somewhere in between for the intellectually curious there is need for an explanation Explaining Jesus explores the possibilities of a secular interdisciplinary science based explanation for the phenomenon of Jesus

Decoding **The Gunn Hilsum Effect**: Revealing the Captivating Potential of Verbal Expression

In a period characterized by interconnectedness and an insatiable thirst for knowledge, the captivating potential of verbal expression has emerged as a formidable force. Its ability to evoke sentiments, stimulate introspection, and incite profound transformations is genuinely awe-inspiring. Within the pages of "**The Gunn Hilsum Effect**," a mesmerizing literary creation penned by way of a celebrated wordsmith, readers set about an enlightening odyssey, unraveling the intricate significance of language and its enduring impact on our lives. In this appraisal, we shall explore the book's central themes, evaluate its distinctive writing style, and gauge its pervasive influence on the hearts and minds of its readership.

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