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| 1. Record Nr. | UNISALENTO991003706899707536 |
| Autore | Ghinatti, Franco |
| Titolo | Assemblee greche d'Occidente / Franco Ghinatti |
| Pubbl/distr/stampa | Torino : Società Editrice Internazionale, 1996 |
| ISBN | 8805056812 |
| Descrizione fisica | XI, 138 p. |
| Lingua di pubblicazione | Italiano |
| Formato | Materiale a stampa |
| Livello bibliografico | Monografia |
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|-------------------------|---|
| 2. Record Nr. | UNINA9910812880603321 |
| Autore | Tripon-Canseliet Charlotte |
| Titolo | Nanoscale microwave engineering : optical control of nanodevices // Charlotte Tripon-Canseliet, Jean Chazelas |
| Pubbl/distr/stampa | London, England ; ; Hoboken, New Jersey : , : ISTE : , : Wiley, , 2014
©2014 |
| ISBN | 1-118-92540-8
1-118-92538-6
1-118-92539-4 |
| Descrizione fisica | 1 online resource (136 p.) |
| Collana | FOCUS : Nanoscience and Nanotechnology Series, , 2051-249X
FOCUS Series |
| Disciplina | 621.3813 |
| Soggetti | Microwave devices
Microwaves - Industrial applications
Nanostructured materials |
| Lingua di pubblicazione | Inglese |
| Formato | Materiale a stampa |
| Livello bibliografico | Monografia |
| Note generali | Description based upon print version of record. |
| Nota di bibliografia | Includes bibliographical references and index. |
| Nota di contenuto | Cover; Title Page; Contents; Introduction; Chapter 1. Nanotechnology- |

based Materials and Their Interaction with Light; 1.1. Review of main trends in 3D to 0D materials; 1.1.1. Main trends in 3D materials for radio frequency (RF) electronics and photonics; 1.1.2. Main trends in 2D materials for RF electronics and photonics; 1.1.3. Review of other two-dimensional structures for RF electronic applications; 1.1.4. Main trends in 1D materials for RF electronics and photonics; 1.1.5. Other 1D materials for RF applications; 1.1.6. Some attempts on 0D materials; 1.2. Light/matter interactions 1.2.1. Fundamental electromagnetic properties of 3D bulk materials 1.2.2. Linear optical transitions; 1.3. Focus on two light/matter interactions at the material level; 1.3.1. Photoconductivity in semiconductor material; 1.3.2. Example of light absorption in metals: plasmonics; Chapter 2. Electromagnetic Material Characterization at Nanoscale; 2.1. State of the art of macroscopic material characterization techniques in the microwave domain with dedicated equipment; 2.1.1. Static resistivity; 2.1.2. Carrier and doping density; 2.1.3. Contact resistance and Schottky barriers 2.1.4. Transient methods for the determination of carrier dynamics 2.1.5. Frequency methods for complex permittivity determination infrequency; 2.2. Evolution of techniques for nanomaterial characterization; 2.2.1. The CNT transistor; 2.2.2. Optimizing DC measurements; 2.2.3. Pulsed I-V measurements; 2.2.4. Capacitance-voltage measurements; 2.3. Micro- to nano experimental techniques for the characterization of 2D, 1D and 0D materials; Chapter 3. Nanotechnology-based Components and Devices; 3.1. Photoconductive switches for microwave applications; 3.1.1. Major stakes; 3.1.2. Basic principles 3.1.3. State of the art of photoconductive switching 3.1.4. Photoconductive switching at nanoscale - examples; 3.2. 2D materials for microwave applications; 3.2.1. Graphene for RF applications; 3.2.2. Optoelectronic functions; 3.2.3. Other potential applications of graphene; 3.3. 1D materials for RF electronics and photonics; 3.3.1. Carbon nanotubes in microwave and RF circuits; 3.3.2. CNT microwave transistors; 3.3.3. RF absorbing and shielding materials based on CNT composites; 3.3.4. Interconnects; Chapter 4. Nanotechnology-based Subsystems; 4.1. Sampling and analog-to-digital converter 4.1.1. Basic principles of sampling and subsampling 4.1.2. Optical sampling of microwave signals; 4.2. Photomixing principle; 4.3. Nanoantennas for microwave to THz applications; 4.3.1. Optical control of antennas in the microwave domain; 4.3.2. THz photoconducting antennas; 4.3.3. 2D material-based THz antennas; 4.3.4. 1D material-based antennas; 4.3.5. Challenges for future applications; Conclusions and Perspectives; C.1. Conclusions; C.2. Perspectives: beyond graphene structures for advanced microwave functions; C.2.1. van der Waals heterostructures C.2.2. Beyond graphene: heterogeneous integration of graphene with other 2D semiconductor materials

Sommario/riassunto

This book targets new trends in microwave engineering by downscaling components and devices for industrial purposes such as miniaturization and function densification, in association with the new approach of activation by a confined optical remote control. It covers the fundamental groundwork of the structure, property, characterization methods and applications of 1D and 2D nanostructures, along with providing the necessary knowledge on atomic structure, how it relates to the material band-structure and how this in turn leads to the amazing properties of these structures. It thus provides n

