CHAPTER 16

ELECTRONIC SCIENCE

Doctoral Theses

202. AGGARWAL (Ruchika)
Modeling, Characterization and Simulation of Algan/Gan Metal Insulator Semiconductor Heterostructure Field Effect Transistor (MISHFET) for High Power Microwave Applications.
Supervisor : Dr. Mridula Gupta
Th 16668

Abstract

Focuses on developing physics based models for device structure optinmization and performance prediction of AIGaN/GaN MISHFETs with special emphasis on the tole of piezoelectric and spontaneous polarization effects. The analysis relates the device performance to various important device and material parameters. Valadity of these analytical models developed for the new proposed structure is shown by comparing the results with the experimental data.

Contents

1. Introduction. 2. Analytical drain current modeling of Si3N4/ AlGaN/GaN metal insulator semiconductor heterostructure field effect transistor (MISHFET) : A comparative study with conventional HFETs for High Power Microwave Applications. 3. RF performance assessment of AlGaN/GaN MISHFET at high temperatures for improved power and pinch-off characteristics. 4. Improved linearity performance of AlGaN/GaN MISHFET over conventional HFETs : An optimization study for wireless infrastructure applications. 5. Simulation and gate insulator engineering of quarter sub micron AlGaN/GaN MISHFET for improved transconductance, cut-off frequency and carrier transport properties. 6. Conclusion & future scope of research. Bibliography.

203. PATRA (Krishna Chandra)
Multiple Coupled Mode Analysis for Strongly Coupled Optical Waveguide Arrays and Long Period Gratings in Tapered Optical Fibers.
Supervisors : Prof. Enakshi Khular Sharma and Dr. Sangeeta Srivastava
Th 16666

Abstract

This thesis is primarily on the multiple coupled mode ananlysis for strongly coupled diffused channel optical waveguide arrays and long period gratings in tapered optical fibers. Lithium Niobate is an anisotropic material with high electro-optical communication window. Waveguides are fabricated on Lithium Niobate substrates by in-diffusion of a dopant, almost exclusively Titanium, to raise the refractive index. Hence Titanium in-diffused Lithium Niobate channel waveguide arrays. A Long Period Grating (LPG), displays wavelength selective properties in transmission. Analysed Long Period gratings in tapered optical fibers and have obtained distinctive features in the transmission spectra.

Contents

1. Introduction. 2. Integrated optical waveguides. 3. Optical fibers. 4. Coupled mode analysis. 5. Power exchange in the evanescently coupled graded index N-waveguide array. 6. Long period grating in tapered optical fibers. 7. Sensor applications of long period gratings in tapered optical fiber. Bibliography.

204. SINGH (Himanshu)
Modeling of Step Discontinuity in Microstrip Lines and Computation of Losses in Multilayer Coplanar Waveguide (CPW) Structure.
Supervisor : Prof. A. K. Verma
Th 16667

Abstract

The study has two parts. The part one is related to the improved microstrip step discontinuity models and their extension to the multilayer isotropic and anisotropic substrates. The part two discusses the computation of teh dielectric and conduclor losses of the multilayer CPW line. The CPW is an important structure in the MMIC technology. The MMIC technology required the CPW under the multilayer dielectric medium. At present there

is no closed form simple model to compute the dielectric and conductor losses of the multilayer CPW. Reports methods to compute both the losses. The conductor loss is computed by the Wheeler's incremental inductance rule in the format of the SLR. The dielectric loss is computed by adopting the SLR process to the multilayer lossy dielectric medium for the CPW.

Contents

205. SINGH (Inderpreet)
Development and Characterization of Carbon Nanotube Based Composites for Device Applications.
Supervisor : Prof. P. K. Bhatnagar
Th 16670

Abstract

Deals with the development of a conjugated polymer based nanocomposite using single walled carbon nanotubes (SWNTs) as the nanomaterial SWNTs are selected due to their several extraordinary properties. They have very high mechanical strength and high thermal conductivity, therefore, large area thin film flexible arrays can be fabricated using these composite films from which a large power can be derived. SWNTs have high absorption in the near infrared region, hence the composite films can harvest a large solar spectrum from visible (by polymer) to infrared (by SWNTs). Further, SWNTs have very high affinity for electrons and high mobility for the charge carriers and due to their one dimensional structure SWNTs establish an interconnected network int he polymer film thereby enhancing the conductivity of the films by several orders of magnitude. Prepared MEH-PPV-SWNT composite films and used them as ETL in MEH-PPV based PLEDs (PLED structure : ITO/ PEDOT:PSS/MEH-PPV(emissive/MEH-PPV-SWNT/Al). Successfully fabricated high efficiency PLEDs having luminance ~5 times higher as compared to the routinely made PLEDs without ETL. Established a simple methods to fabricate multilayer PLEDs using solution processing method. This method can be used to produce any multilayer polymer device by solution processing.

Contents

1. Introduction. 2. Experimental techniques. 3. Conjugated polymer- single walled carbon nanotube composite films. 4. Electrial conductivity in composite films. 5. Device application: Composite films in PLEDs. 6. Conclusions and futue scope of work. Bibliography.

206. SINGH (Nandan)
Study of Classical and Quantum Correlation Properties of Optical Fields.
Supervisors : Prof. Enakshi K. Sharma and Dr. H. C. Kandpal
Th 16669

Abstract

Diffraction-induced and temporal correlation-induced spectral changes studies have been made and their applications for information encoding, hiding and transmission have been explored. The spatial correlation of optical fields studies have been made for classical subwavelength interference effect and imaging applications. The quantum correlation based absolute quantum metrology laboratory has been established at National Physical Laboratory, New Delhi, India.

Contents

1. Introduction. 2. Diffraction-induced spectral anomalies for information encoding and information hiding. 3. Temporal correlation-induced spectral changes and their applications. 4. Classical subwavelength interference effect. 5. Far field thermal ghost-imaging as influenced by the source properties, object characteristics and polarization. 6. Sensitivity of near field thermal lensless ghost-imaging. 7. Quantum correlated (entangled) photons and absolute quantum metrology. Bibliography.