



Distributed Feedback Semiconductor Lasers

Anne-Marie Haughey



Distributed Feedback Semiconductor Lasers Distributed Feedback Semiconductor Lasers:

Distributed Feedback Semiconductor Lasers John E. Carroll, James Whiteaway, Dick Plumb, 1998 Concentrating on presenting a thorough analysis of DFB lasers from a level suitable for research students this book emphasises and gives extensive coverage of computer aided modeling techniques Distributed Feedback Laser Diodes and Optical Tunable Filters H. Ghafouri-Shiraz, 2003-11-07 Advances in optical fibre based communications systems have played a crucial role in the development of the information highway By offering a single mode oscillation and narrow spectral output distributed feedback DFB semiconductor laser diodes offer excellent optical light sources as well as optical filters for fibre based communications and dense wavelength division multiplexing DWDM systems This comprehensive text focuses on the basic working principles of DFB laser diodes and optical filters and details the development of a new technique for enhanced system performance Considers the optical waveguiding characteristics and properties of semiconductor materials and the physics of DFB semiconductor lasers Presents a powerful modelling technique based on the transfer matrix method which can be used to improve the design of laser diodes optical fibres and amplifiers Examines the effect of the various corrugation shapes on the coupling coefficients and lasing characteristics of DFB laser diodes Technical advice to improve immunity against the spatial hole burning effect Extensive referencing throughout and a comprehensive glossary of symbols and abbreviations Suitable for both introductory and advanced levels This is an indispensable textbook for undergraduate and postgraduate students of electrical and electronic engineering and physics as it consolidates their knowledge in this rapidly growing field As a technical guide for the structural design of DFB laser diodes and optical filters the book will serve as an invaluable reference for researchers in opto electronics and semiconductor device physics *Distributed Feedback Laser Diodes* Dr. H. Ghafouri-Shiraz, B. S. K. Lo, 1996-08-06 Distributed Feedback Laser Diodes Principles and Physical Modelling H Ghafouri Shiraz B S K Lo University of Birmingham UK Advances in optical fibre based communications systems have played a crucial role in the development of the information highway By offering a single mode oscillation and narrow spectral output distributed feedback DFB semiconductor laser diodes offer an excellent optical light source for fibre based communication systems This comprehensive text focuses on the basic working principles of DFB laser diodes and details the development of a new technique for enhanced system performance Considers the optical waveguiding characteristics and properties of semiconductor materials and the physics of DFB semiconductor lasers Presents a powerful modelling technique based on the transfer matrix method which can be used to improve the design of laser diodes optical filters and amplifiers Examines the effect of the various corrugation shapes on the coupling coefficients and lasing characteristics of DFB laser diodes Technical advice to improve immunity against the spatial hole burning effect Extensive referencing throughout and a comprehensive glossary of symbols and abbreviations Distributed Feedback Laser Diodes is an indispensable text for senior students of electrical and electronic engineering and physics and will consolidate their knowledge in this rapidly growing field As a

technical guide for the structural design of DFB laser diodes it will serve as an invaluable reference for researchers in optoelectronics and semiconductor and device physics

Handbook of Distributed Feedback Laser Diodes, Second Edition Geert Morthier, Patrick Vankwikelberge, 2013-09-01 Since the first edition of this book was published in 1997 the photonics landscape has evolved considerably and so has the role of distributed feedback DFB laser diodes Although tunable laser diodes continue to be introduced in advanced optical communication systems DFB laser diodes are still widely applied in many deployed systems This also includes wavelength tunable DFB laser diodes and DFB laser diode arrays usually integrated with intensity or phase modulators and semiconductor optical amplifiers This valuable resource gives professionals a comprehensive description of the different effects that determine the behavior of a DFB laser diode Special attention is given to two new chapters on wavelength tunable DFB laser diodes and bistable and unstable DFB laser diodes Among many other updates throughout the reference semiconductor and electromagnetic professionals are also provided two new appendices This book fully covers the underlying theory commercial applications necessary design criteria and future direction of this technology

Dynamics of Distributed Feedback Lasers and Semiconductor Laser Arrays Yuan-Hwang Liao, 1997

Distributed Feedback Laser Diodes and Optical Tunable Filters Dr. H. Ghafouri-Shiraz, 2004-02-06 Advances in optical fibre based communications systems have played a crucial role in the development of the information highway By offering a single mode oscillation and narrow spectral output distributed feedback DFB semiconductor laser diodes offer excellent optical light sources as well as optical filters for fibre based communications and dense wavelength division multiplexing DWDM systems This comprehensive text focuses on the basic working principles of DFB laser diodes and optical filters and details the development of a new technique for enhanced system performance Considers the optical waveguiding characteristics and properties of semiconductor materials and the physics of DFB semiconductor lasers Presents a powerful modelling technique based on the transfer matrix method which can be used to improve the design of laser diodes optical fibres and amplifiers Examines the effect of the various corrugation shapes on the coupling coefficients and lasing characteristics of DFB laser diodes Technical advice to improve immunity against the spatial hole burning effect Extensive referencing throughout and a comprehensive glossary of symbols and abbreviations Suitable for both introductory and advanced levels This is an indispensable textbook for undergraduate and postgraduate students of electrical and electronic engineering and physics as it consolidates their knowledge in this rapidly growing field As a technical guide for the structural design of DFB laser diodes and optical filters the book will serve as an invaluable reference for researchers in optoelectronics and semiconductor device physics

Modeling of Distributed Feedback Semiconductor Lasers Meng-Mu Shih, 2010 ABSTRACT This work demonstrates the multi parameter modeling processes of calculating coupling coefficients of the optical waveguide structures for various distributed feedback DFB semiconductor lasers These lasers operate on Near Mid IR and TE TM modes Substrate emitting DFB quantum cascade laser

analyzed and performance improvement are discussed *Distributed Feedback Laser Diodes*, 2018-05 The accumulative demand for high bandwidth communications has been liable for the hasty development of Optical Communication Systems OCS These systems employ fiber optics to convey electromagnetic waves and need to take into account the undesired effects of dispersion and reduction on the bandwidth In recent year distributed feedback laser was one of the substantial topics that have been study for many years It was introduced and developed by Kogelnik and Shank Since that model release people are now recognizing distributed feedback laser are imperative to human requisite Distributed feedback lasers are useful item in society or the world because it provides the phase difference between the gain and the index grating based on using power series method to resolve the couple wave equation that reveals the calculation of the threshold gain margin which located in complex couple distributed feedback laser This handbook brings together cutting edge research and reviews on distributed feedback laser diodes illustrates the method of calculation the threshold gain margin that play important role in the optic world This volume is intended to the study of semiconductor lasers with distributed feedback DFB namely their usage as the light source in high bit rate optical communication systems OCS This is particularly important in situations where direct modulation DM of the emitter is used In addition it also presents emphasis how distributed feedback laser DFB play important role in optic world and the advantage or disadvantage of using DFB The fabrication of high efficiency distributed feedback laser diodes is described **High-speed Modulation of Distributed-feedback Semiconductor Lasers** Amit Dhawan, 1997 *Organic Semiconductor Lasers with Two-dimensional Distributed Feedback* Stefan Riechel, 2002 *Laser Diode Microsystems* Hans Zappe, 2013-03-14 Laser Diode Microsystems provides the reader with the basic knowledge and understanding required for using semiconductor laser diodes in optical microsystems and micro optical electromechanic systems This tutorial addresses the fundamentals of semiconductor laser operation and design coupled with an overview of the types of laser diodes suitable for use in Microsystems along with their distinguishing characteristics Emphasis is placed on laser diode characterization and measurement as well as the assembly techniques and optical accessories required for incorporation of semiconductor lasers into complex microsystems Equipped with typical results and calculation examples this hand on text helps readers to develop a feel for how to choose a laser diode characterize it and incorporate it into a microsystem **Distributed Feedback Lasers** I. Ladany, 1988 **Investigation of monolithically integrated spectral stabilization in high-brightness broad area diode lasers** Jonathan Decker, 2018-06-06 High power distributed feedback broad area DFB BA lasers are key components for pumping narrow absorption bands in solid state lasers and for brightness scaling in direct diode laser systems via dense spectral beam combining Today the market for these lasers is dominated by DFB BA lasers with low order Bragg gratings that are integrated via buried overgrowth techniques A promising alternative are DFB BA lasers with high order gratings that are directly etched into the p side of the epitaxial layer structure so that no interruption of the epitaxial growth process is required Prior to this work studies of such DFB BA lasers were restricted to

experimental proof of principal realizations Further adequate simulation tools were not available as surface etched gratings introduce a high refractive index contrast and can therefore not be calculated directly within the coupled mode theory CMT Hence this work treats the development of efficient high brightness DFB BA lasers and laser arrays with surface etched gratings at 975 nm The development of these lasers encompasses three steps First a design study of high brightness Fabry P rot laser diodes that are suitable for the integration of surface etched gratings Second the implementation of an adequate numerical model for the simulation of high order surface etched DFB grat ings Therefore a simulation based on CMT is extended by bi directional eigenmode expansion and propagation modelling And third a comprehensive experimental study of spectrally stabilized high brightness DFB BA lasers Optimized DFB BA lasers L 6 mm W 30 m operate with 56% peak conversion efficiency and achieve 5.8 W output power with a slow axis beam parameter product 1.8 mm mrad and a linewidth 1.0 nm

Semiconductor Diode Lasers William Streifer, Michael Ettenberg, 1991 Distributed-feedback (DFB) Laser Coherence and Linewidth Broadening Linh V. T. Nguyen, 2003 *Investigation of spectral characteristics of solitary diode lasers with integrated grating resonator* Thanh Phuong Nguyen, 2011-03-30 *Tunable Single-wavelength Semiconductor Lasers* Ming-Chiang Abraham Wu, 1988 Introduction to Semiconductor Lasers for Optical Communications David J. Klotzkin, 2020-01-07

This updated second edition textbook provides a thorough and accessible treatment of semiconductor lasers from a design and engineering perspective It includes both the physics of devices as well as the engineering designing and testing of practical lasers The material is presented clearly with many examples provided Readers of the book will come to understand the finer aspects of the theory design fabrication and test of these devices and have an excellent background for further study of optoelectronics

A Distributed Feedback for Organic Semiconductor Laser Platform for Assessing the Risk of Cardiovascular Disease Anne-Marie Haughey, 2014 Organic distributed feedback DFB lasers are a class of evanescent wave technology that can be used to measure changes in refractive index at the laser surface These sensors are highly attractive for biosensing applications as they provide a sensitive platform for the label free detection of a range of analytes possibly in real time and they can be multiplexed for the detection of a suite of different analytes from a single test sample The simple implementation of DFB lasers for sensing also means that they can be packaged into a compact sensing platform this is especially true of DFB lasers incorporating an organic semiconductor as the gain layer where optical pumping may be performed with a compact source such as a laser diode In addition organic semiconductor based DFB lasers have the potential for improved sensitivity relative to other organic DFB lasers such as dye doped as the refractive index of organic semiconductors is generally higher which leads to an increase in the interaction of the laser mode with the analyte binding region at the laser surface In this thesis the first demonstration of an organic semiconductor oligofluorene truxene T3 DFB laser for biosensing applications is described Sensor development is focused on the ultimate aim of incorporating a T3 DFB laser into a compact and portable highthroughput sensing platform for the

detection of cardiac biomarkers Apolipoprotein B100 C reactive protein and B type natriuretic peptide in particular Detection of these biomarkers is to be achieved via functionalisation of the T3 surface with oligonucleotide based probes The structure of the T3 DFB laser is optimised experimentally and theoretically by tuning the gain layer thickness to maximise sensitivity to changes in refractive index at the laser surface such as the binding of an analyte The optimised laser sensor has a laser threshold of 30 J cm² 6 kW cm² 5 ns pulse duration which makes optical pumping with a laser diode a possibility The sensing potential of the DFB laser is shown via the detection of bulk solution refractive index changes and the addition of biomolecules to the laser surface where a bulk sensitivity of 22 nm per refractive index unit is observed The specific biosensing potential of the laser is highlighted through the functionalisation of the laser surface with biotin molecules and the subsequent detection of the complementary protein avidin The lowest limit of avidin detection achieved is 1 g mL⁻¹ at this level of sensitivity the current T3 laser is expected to be able to detect the larger and more abundant of two of the three cardiac biomarker targets ApoB and CRP The effects of structural changes to device sensitivity are modelled theoretically and demonstrate that detection of BNP may be achieved through the addition of a high index cladding layer a technique currently used for dye doped DFB lasers The first demonstration of a DFB laser used for reversible sensing is also presented in this thesis Through the use of desthiobiotin a biotin analogue reversible avidin detection is performed A reversible biosensor may be of particular interest for applications where a large number of repeated measurements are required and may be prohibitive to the use of single use disposable sensors Finally functionalisation of the DFB laser with oligonucleotide probes is described Several different techniques are explored for immobilisation of oligonucleotide probes on the T3 surface with click chemistry and sulfhydryl linkage chemistries showing the most promise

Characteristics of Distributed Feedback Semiconductor Lasers with Chirped Corrugated Gratings Ping Zhou,1990

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