



Fethallah Karim

# Fiber Bragg gratings: channels' densification and tunability



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# Fiber Bragg Gratings Channels densification And Tunability

**Anthony S. Fauci**



## **Fiber Bragg Gratings Channels densification And Tunability:**

Fiber Bragg Gratings: Channels' densification and Tunability Fethallah Karim, 2014-03 This book gives an overview of Fiber Bragg gratings and specially on sampled gratings which are used in WDM transmission links In this document several methods for channel s densification are presented We focus also on channel s tunability by applying strain and temperature effects Finally multiplexeurs and demultiplexers based on uniform Bragg gratings are presented and analyzed at the end of this manuscript **Full Matlab Code for Synthesis and Optimization of Bragg Gratings** Fethallah Karim, 2018-11-07 This book presents a theoretical description of fiber Bragg gratings focusing on channels densification and the tunability of Bragg filters It also includes a full Matlab code for the synthesis and optimization of several kinds of fiber Bragg gratings by using the directed tabu search the simulated annealing method and the genetic algorithm Physical and optical parameters of uniform chirped and sampled fiber Bragg gratings are then reconstructed with these algorithms *Fiber Bragg Gratings* Raman Kashyap, 1999-03 Forward Preface Introduction Photosensitivity and Photosensitization of Optical Fibers Fabrication of Bragg Gratings Theory of Fiber Bragg Gratings Apodisation of Fiber Gratings Fiber Grating Band Pass Filters Chirped Fiber Bragg Gratings Fiber Grating Lasers and Amplifiers Measurement and Characterization of Gratings Index **Fiber Bragg Gratings** Andreas Othonos, Κυριάκος Καλλή, 1999 Fiber Bragg gratings are flexible cost effective and highly efficient with a vast range of potential applications This timely new work provides a comprehensive description of the principles and practical applications of this latest technology which has the potential to revolutionize telecommunications and significantly impact optical fiber sensing Here the authors explain the underlying physics and practical aspects in a clear and unambiguous manner Analysis and Development of a Tunable Fiber Bragg Grating Filter Based on Axial Tension/compression , 2005 Fiber Bragg gratings FBGs are key elements in modern telecommunication and sensing applications In optical communication with the advancement of the Erbium doped fiber amplifier EDFA there is a great demand for devices with wavelength tunability over the Erbium gain bandwidth in particular for wavelength division multiplexing WDM networks The center wavelength of a FBG can be shifted by means of change of temperature pressure or mechanical axial strain The axial strain approach is the best method among all other techniques because it allows relatively large wavelength shifts with high speed Axial strain of up to 4% will be required to cover the whole EDFA region more than 40 nm of central wavelength shift The formation of Bragg grating results in significant reduction in mechanical strength of optical fibers especially in tension As a result axial strain of only about 1% can be achieved by mechanical stretching of FBGs In order to achieve the remaining 3% strain compression of FBGs has to be applied In this thesis the design and analysis of a novel device for achieving central wavelength shift are presented In particular the device has achieved for a fiber with 12 mm FBG a shifting of 46 nm in compression and 10.5 nm in tension with a reflection power loss of less than 0.25 dB and a FWHM bandwidth variation of approximately 0.1 nm Both variations are well below the Bellcore standards requirement of 0

5 dB for peak reflectivity variation and 0.1 nm for bandwidth variation. The device consists of two fixed and one guiding ferrules. The difficulties associated with compressing the FBG were handled by carefully selecting tolerances and adjustment procedures. The device allows both tension and compression of FBGs and the use of different FBG lengths and actuators. The effects of glue deformation and bending of the FBG during compression were analyzed in detail. Further using the piezoelectric transducer PZT actuator as a driver tuning sp

**Tunable Fiber Bragg Grating Using Evanescent Field Coupling** Jae-yoon Jeong, 2001. In this work we present experimental results on tenability of fiber Bragg grating incorporating evanescent field coupling. Evanescent field is the exponentially decaying part of an optical mode formed in a waveguide. A section of fiber with a Bragg grating written in it is side polished until most of the cladding is removed. The evanescent field is modified by applying different index matching oil and by placing a dielectric material on the polished area of the fiber. A tunability as much as 5 nm was demonstrated as the applied index matching oil varied from  $n = 1.40$  to  $n = 1.45$ . Polarization dependent behavior of the device was also measured and it was found out that the polarization component that is perpendicular to the polished surface experiences severe loss. A prototype tunable grating device incorporating a MEMS structure is also discussed.

Polymer Optical Fiber Bragg Gratings Ricardo Oliveira, Lucia Maria Botas Bilro, Rogerio Nogueira, 2019-11-12. Describes the systems commonly employed for producing fiber Bragg gratings. FBGs in silica fibers that can be used for the production of POFBGs. Explores different laser sources for the inscription of POFBGs. Explores the capability of using this technology at the visible and infrared region in different fiber types e.g. step index microstructured unclad highly birefringent and in fibers composed of different polymer materials such as PMMA doped PMMA PS and ZEONEX. Reports the fabrication of different types of POF gratings such as uniform phase shifted tilted chirped and long period gratings. Shows the opportunities of POFBGs for a variety of sensing applications.

*Polymer Optical Fiber Bragg Gratings Technology* Hisham Kadhum, 2016-10-16

**Tunable Phase-shifted Fiber Bragg Gratings and Its Applications in the Microwave Region**, 2009

**Tunable Fiber Bragg Grating Filters** Alessandro Iocco, 1999. *Development of Apodized Fiber Bragg Grating for Application in Tunable Fiber Laser and as a High Temperature Sensor* Seng Sean Chong, 2012

A Technology Assessment of Bragg Grating Fiber Optic Based Nondestructive Evaluation (NDE) H. Thomas Yolken, George A. Matzkanin, 2001

**An Optical Tunable Filter Using a Single Fiber Bragg Grating** Siti Nafisah Md. Rashid, 2008

**Fiber Bragg Gratings** Marcelo Martins Werneck, Regina Célia da Silva Barros Allil, Fábio Vieira Batista de Nazaré, 2017. This Tutorial Text delivers essential information concerning fiber Bragg gratings to professionals and researchers with an approach based on rules of thumb and practical aspects enabling quick access to the main principles and techniques and allowing readers to set up their own laboratory or application. It provides detailed information about how to operate and use these novel sensors particularly with respect to the required infrastructure, daily operation and possible applications. After a discussion of the primary concepts, practical aspects regarding the development of a FBG laboratory and

how these components are manufactured and used in practical applications are presented The following chapters outline the operation of Bragg gratings and for instance discuss how measurement information can be retrieved interrogation techniques calibration methods and how to prepare and deploy the devices in real monitoring conditions The final chapters present several successful real world applications of the technology

**Current Trends in Short- and Long-period Fiber Gratings** Christian Cuadrado-Laborde,2013-05-15 In this book the reader will find a collection of chapters written by different experts around the world describing the current research trends in both short and long period fiber grating technology This work is mainly addressed to researchers already working in this area but it is also accessible to anyone with a scientific background who desires to have an updated overview of the recent progress in this domain It will also be valuable to scientist and engineers who have become newly involved in this field Each chapter is self contained and can be read independently of the others This book intends to provide highlights of the current research in this area showing the recent advances in the field of fiber gratings

**Current Trends in Short and Longperiod Fiber Gratings** Edwin Falk,2016-04-01 A fiber Bragg grating FBG is a type of distributed Bragg reflector constructed in a short segment of optical fiber that reflects particular wavelengths of light and transmits all others This is achieved by creating a periodic variation in the refractive index of the fiber core which generates a wavelength specific dielectric mirror A fiber Bragg grating can therefore be used as an inline optical filter to block certain wavelengths or as a wavelength specific reflector Fiber Bragg gratings are created by inscribing or writing systematic periodic or aperiodic variation of refractive index into the core of a special type of optical fiber using an intense ultraviolet UV source such as a UV laser A long period fiber grating couples light from a guided mode into forward propagating cladding modes where it is lost due to absorption and scattering It is an optical fiber structure with the properties periodically varying along the fiber such that the conditions for the interaction of several copropagating modes are satisfied The period of such a structure is of the order of a fraction of a millimeter In contrast to the fiber Bragg gratings LPFGs couple copropagating modes with close propagation constants therefore the period of such a grating can considerably exceed the wavelength of radiation propagating in the fiber Because the period of an LPFG is much larger than the wavelength LPFGs are relatively simple to manufacture Since LPFGs couple copropagating modes their resonances can only be observed in transmission spectra Long period grating has a wide variety of applications including band rejection filters gain flattening filter and sensors Various gratings with complex structures have been designed gratings combining several LPFGs LPFGs with superstructures chirped gratings and gratings with apodization Various LPFG based devices have been developed filters sensors fiber dispersion compensators etc This book entitled Current Trends in Short and Long period Fiber Gratings emphasizes the current trends in both short and long period fiber grating technology This book intends to provide highlights of the current topics in this area showing the recent advances in the field of fiber gratings

**Simulation of Dual Fibre Bragg Gratings as a Fabry-perot Tunable Filter** Siti Nafisah Md. Rashid,2010 *Optical*

*Fiber Bragg Gratings* David A. Brown, Quin Zhang, 1995

**Fiber Bragg Gratings** Evangelos Vasilios Diatzikis, 1998

ABSTRACT Bragg gratings were written into the core of an optical fiber using a phase mask and a continuous wave ultraviolet laser. The gratings exhibited a temperature induced shift in the Bragg wavelength. Fiber samples were exposed to hydrogen loading which resulted in enhanced photosensitivity of the fiber core, shorter writing times, and higher reflecting gratings. Phase shifted Bragg gratings were fabricated by utilizing the spatial modes of the ultraviolet laser during writing. A demodulation technique for fiber Bragg grating sensors is presented. It is based on the generation of an electrical carrier by using a modulated multimode laser diode to illuminate the fiber grating. The change in Bragg wavelength is measured by tracking the phase of the carrier at the detector output in either an open or a closed loop scheme. Experimental data was obtained for both strain and temperature measurements. The system showed a strong immunity to optical power fluctuations. The application of this demodulation scheme to a multiplexed sensing system is also demonstrated.

Mechanical Reliability of Optical Fiber Bragg Gratings Dimitrios Varelas, 1998

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