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OPTICAL FIBER SENSORS

Advanced Techniques
and Applications

EDITED BY **Ginu Rajan**

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Advanced Techniques and Applications

EDITED BY **Ginu Rajan**

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Preface

In the past several decades since the invention of the laser in 1960 and the development of modern low-loss optical fibers in 1966, optical fiber technology has made a transition from the experimental stage to practical applications. The main focus of the development of optical fiber has always been on telecommunications, but the early 1970s saw some of the first experiments on low-loss optical fibers being used for sensor purposes. The field of optical fiber sensing has continued to progress and has developed enormously since that time. Magnetic, pressure, temperature, acceleration, displacement, fluid level, current, and strain optical fiber sensors were among the first types extensively investigated and explored for sensing and measurement. Compared with other types of sensors, optical fiber sensors exhibit a number of advantages, such as immunity to electromagnetic interference, applicability in high-voltage or explosive environments, a very wide operating temperature range, multiplexing capabilities, and chemical passivity. This book describes the fundamentals of optical fiber sensors, the latest developments in the field, and the practical applications of the optical fiber sensing technology.

This book covers wide aspects of different sensing mechanisms using optical fibers and also demonstrates their use in application areas. Chapters based on new and emerging areas such as photonic crystal fiber sensors, micro-/nanofiber sensing, liquid crystal photonics, acousto-optic effects in fiber and its sensing applications, and fiber laser-based sensing and other well-established areas such as surface plasmon resonance sensors, interferometric fiber sensors, polymer fiber sensors, Bragg gratings in polymer and silica fibers, and distributed fiber sensors are also included in this book. On the application side of optical fiber sensors, humidity sensing applications, smart structure applications, and medical applications are also covered. A future outlook on the fiber sensing research area is also presented to provide the reader with an understanding of its potential.

This book is a collective effort of a number of authors who contributed different chapters in their areas of expertise. With such a wide variety of topics covered in detail, we are hoping that the reader will find this book stimulating to read and will discover the sensing potential of optical fibers and devices. This book is intended to be a comprehensive introduction with a strong practical focus suitable for undergraduate and graduate students as well as a convenient reference for scientists and engineers working in the field.

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Editors

Dr. Ginu Rajan is vice-chancellor's research fellow/lecturer at the University of New South Wales, Sydney, Australia. He earned his BSc in physics from the University of Kerala and MSc in applied physics from Mahatma Gandhi University, Kerala, India, in 2000 and 2002, respectively. He worked as a researcher at the Indian Institute of Astrophysics during the period of 2003–2005. He subsequently undertook research in the area of optical fiber sensors, following which he earned a PhD from Dublin Institute of Technology (DIT), Ireland, in 2008.

During 2009–2012, Dr. Rajan worked as a project manager/research associate at the Photonics Research Centre of DIT in collaboration with the Warsaw University of Technology, Poland. He also was a lecturer at DIT during this period. He has published more than 100 journal articles, conference papers, and book chapters. He also holds a patent. Dr. Rajan is currently a reviewer for many scientific journals and also an international reviewer for funding applications of the Portugal Science Foundation and Australian Research Council. His research and teaching interests include optical fiber sensors and their applications in biomedical engineering, fiber Bragg grating (FBG) interrogation systems, photonic crystal fiber sensors, polymer fiber sensors, smart structures, and physics of photonic devices. He can be reached at ginu.rajan@unsw.edu.au or ginurajan@gmail.com.

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