Shien-Kuei Liaw

National Taiwan University of Science and Technology, Taiwan

Hybrid ring /linear cavity fiber laser operating at 1064nm band for sensing

Laser sources with wavelengths at around 1064nm have many practical applications and are widely used in materials processing, display technology, biomedical engineering, and remote sensing applications. The 1064nm laser also has other applications in frequency doubling, optical coherence tomography, micromachining, optical wireless, time-resolved spectrum, etc. In the application of display technology, it is an excellent excitation source for nonlinear optics and biomedical engineering as the biological sample is usually composed of water. Lightwave at 1064nm band is not absorbed by water or oxygen inside the tissue. Hemoglobin, deoxyhemoglobin or melanin absorption can reduce the damage of biological samples, and the Raman light source near the 1064 nm is an ideal light source for medical detection. Semiconductor optical amplifier based hybrid ring cavity/linear cavity fiber laser can also be used as optical sensing source. Compared with conventional sensors, fiber sensors present several advantages, including high sensitivity, great mechanical stability, electromagnetic interference immunity, low cost, compactness, and easy maintenance. The proposed 1064nm SOA based fiber laser can also play as a sensor. In a fiber-laser-based FBG sensing system, the laser cavity forms part of the FBG sensor. Therefore, the changes in the FBG physical condition can be detected directly via the laser spectrum. The dynamic range of the fiber laser sensor is equivalent to the cavity length. Several fiber-laser-based sensors have been reported. Temperature changes can be measured directly using the beat frequency between any two modes. Other fiber ring laser-based structures have recently been proposed for fiber sensing. The Semiconductor Optical Amplifier (SOA) is an ideal alternative because of its inhomogeneous broadening property, which is beneficial to stable multi-wavelength lasing with equalized powers. Such a multi-wavelength FBG-based fiber laser sensor also allows for distributed sensing applications. This kind of fiber laser has other important advantages for long-distance sensing. In this paper, we demonstrate a Semiconductor Optical Amplifier (SOA) based fiber ring laser at 1064nm band. The experiments to sense stretch, squeeze and temperature variation with high linearity for interpolation method will also be introduced with large dynamic range.

Biography: Shien-Kuei Liaw received double doctorate degrees in photonics engineering from National Chiao-Tung University and mechanical engineering from National Taiwan University. He joined the Chunghua Telecommunication, Taiwan, 1993. Dr. Liaw has worked at the department of Electronic Engineering, National Taiwan University of Science and Technology (NTUST) since 2000. He was an academic visitor at the University of Oxford and University of Cambridge in 2011 and 2018, respectively. He owns 40 patents in the U.S., Taiwan and China, authored or co-authored more than 250 journal articles and international conference papers. He has been actively contributing to numerous conferences as a program chair, as an international advisory committee member, a steering committee member, a keynote speaker and an invited speaker. Currently, Dr. Liaw is a Distinguished Professor and Vice Dean of the College of Electrical and Computer Engineering, NTUST and Secretary-General of the Taiwan Photonic Society. His research interests are in fiber sensing, optical communication and reliability testing.

peterskliaw@gmail.com