Abstract

In this doctoral thesis the design, implementation and characterization of optical fibre sensors for the measurement of several magnitudes in harsh environments is presented. Harsh environments are understood as those environmental conditions external to the sensors which by its nature difficult to use and the long-term reliability of the monitoring systems. There are a variety of harsh environments such as extreme temperatures, high pressure, chemicals or ionizing environments, vibration or mechanical shock, among others. This thesis work, realized in the Optical and Quantum Group (GCOC) of the Institute of Telecommunications and Multimedia Applications (iTEAM) of the Universitat Politècnica de València and during the stay in the *School of Engineering and Applied Science* de la Aston University, consider some of these conditions, for this reason in the design and implementation several optical technologies, such as Fibre Bragg Gratings (FBGs) and optical interferometers, have been used in order to optimize the sensor performance.

In first place, an exhausting study of Regenerated Fibre Bragg Gratings (RFBGs) has been realized for extremely high temperatures, near 1300ºC in some cases. This study covers from the fabrication process to the characterization as temperature sensors and long-term stability. Also, a theoretical and experimental study has been performed about the multiplexation of modal interferometers that, by their high sensitivity and robustness, are suitable for the use in harsh environmental conditions. The developed technique allows multiplexing modal interferometers in several configurations minimizing the interference between them. Finally, the implementation of a FBG inscription setup in polymer optical fibres and the use of the obtained devices for the design, implementation and characterization of optical fibre sensors for the measurement of curvatures, high strains and dynamic strains are shown.